SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; JOSEPH LE CONTE, Geology; W. M. DAVIS, Physiography; HENRY F. OSBORN, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; WILLIAM H. WELCH, Pathology; J. MCKEEN CATTELL, Psychology; J. W. POWELL, Anthropology.

FRIDAY, APRIL 12, 1901.

CONTENTS:

George M. Dawson (with plate): PROFESSOR FRANK D. ADAMS..... 561
State Natural History Surveys: PROFESSOR E. A. BIRGE, PROFESSOR H. F. NACHTRIEB, PROFESSOR FRANK SMITH..... 563
The Training of an Electrochemist: PROFESSOR HARRY C. JONES..... 569
Appropriations for the U. S. Department of Agriculture: DR. E. W. ALLEN..... 572
The Reduction to Absurdity of the Ordinary Treatment of the Syllogism: CHRISTINE LADD FRANKLIN..... 574
American Chemical Society..... 576
Scientific Books:—
Renault sur quelques microorganismes des combustibles fossiles: PROFESSOR LESTER F. WARD. *Ball's Elements of Astronomy:* DR. F. W. VERY. *General. Books Received*..... 577
Scientific Journals and Articles..... 582
Societies and Academies:—
The Academy of Science of St. Louis: PROFESSOR WILLIAM TRELEASE. *Geological Society of Washington:* DR. F. L. RANSOME AND DAVID WHITE. *Biological Society of Washington:* F. A. LUCAS. *Torrey Botanical Club:* PROFESSOR EDWARD E. BURGESS. *Science Club of Northwestern University:* DR. HORACE M. SNYDER. 584
Discussion and Correspondence:—
The Application of Precedence of Place in Nomenclature: PROFESSOR N. L. BRITTON. *Clayton's Eclipse Cyclone and the Diurnal Cyclones:* DR. FRANK H. BIGELOW. *The Reversal of the Photographic Image by Continued Action of Light.* ROMYN HITCHCOCK..... 588
Shorter Articles:—
A New Occurrence of Cassiterite in Alaska: ALFRED H. BROOKS. *Notes on Parasites:* DR. CH. WARDELL STILES..... 593
Amateurism and Mental Inertia in Public Service: PROFESSOR R. H. THURSTON..... 594
Museum Methods Abroad: F. A. L..... 595
The Scientific Alliance of New York..... 596
Membership in the National Academy of Sciences.... 597
Scientific Notes and News..... 598
University and Educational News..... 600

GEORGE M. DAWSON.

BY the death of Dr. G. M. Dawson, the Dominion of Canada loses one of her ablest and most distinguished men of science and one whose loss will be felt for many years to come. George Mercer Dawson was the eldest son of the late Sir William Dawson and was born at Pictou, Nova Scotia, on August 1, 1849. In 1855, his father, having received the appointment as Principal of McGill College, left Nova Scotia and came to live in Montreal. The wide college grounds, lying then on the outskirts of the town and backed by Mount Royal, at that time covered with its original forest growth, formed an environment full of interest and delight to the boy, whose mind turned to the study of nature from the first, a study which was made doubly fascinating in his case by his father, who was always ready to encourage him in his work, explain his difficulties and talk with him as a friend.

At the age of ten he entered the High School at Montreal, where he took a high place among the boys of his class. There were, however, at that time, near what is now the center of the city of Montreal, a number of ponds in which the boys from the High School used to go rafting at lunch hour. On one of these occasions he received a drenching and remained in his damp clothes through the afternoon; a chill was induced, which led to spinal trouble,

resulting in years of suffering and final deformity. He consequently left school, and his education, until he was old enough to enter college, was carried on chiefly by private tutors. While not neglecting the ordinary subjects of a school curriculum, he was allowed to follow out lines of study in which he found a particular interest and in this way learned many things which were later of the greatest value to him. Surrounded by books, chemical apparatus, paints and pencils, the days were never too long, and photography, bookbinding, painting magic lantern slides, pyrotechny and even cheese-making were among his many occupations. He seemed to absorb knowledge rather than to study, and was always cheerful, amusing and popular, other boys flocking round him and invariably submitting to his unconscious leadership. At times he suffered much pain and was deprived of many things dear to boys, but was never heard to complain. When quite a lad he often accompanied his father on his geological excursions with the students of McGill College on Saturdays, and even on longer expeditions to Murray Bay, Gaspe and the Joggins, and was always a helpful and bright companion.

At nineteen he had recovered his health and entered McGill College, where he studied for a year, and in the following year entered the Royal School of Mines in London. He went to England in a sailing ship, for the benefit of the longer voyage, and on the way over amused himself by studying navigation under the captain. Years later when he chartered a schooner, in order to make an examination of the Queen Charlotte Islands, the captain of the latter, proving to be drunken and unsatisfactory, was dismissed, and Dawson navigated the schooner himself during the remainder of the trip, and this on a deeply indented and dangerous coast, of which at that time no chart existed.

At the Royal School of Mines he took the regular course, extending over three years, taking the Duke of Cornwall's Scholarship, and the Forbes medal and prize in paleontology and natural history. While at the Royal School of Mines he paid especial attention to the study of geology and paleontology under Ramsay, Huxley and Etheridge, and also devoted much time to the study of chemistry and metallurgy in the laboratories of Frankland and Percy.

Returning to Canada, he was engaged for a year in mine surveys in Nova Scotia and in lecturing at Morrin College, Quebec, and in 1873 was appointed Geologist and Botanist to Her Majesty's North American Boundary Commission, which was to fix the boundary line from the Lake of the Woods to the Rocky Mountains, and which had been at work for over a year. There are but few corners of the earth which now appear so far off as the great Northwest did at that time—a veritable *terra incognita*. Fort Garry, now the city of Winnipeg, was the last point of civilization and the 49th parallel had to be traversed on horseback or on foot, the provisions and materials being taken along in Red River carts. The difficulties now experienced in traversing that district were then increased by its remoteness from civilization and the fact that it was unexplored. In summer there was not only the scorching heat of the Plains, but the prairie fires, the difficulty of procuring and carrying firewood, the scarcity of water, and, in the late autumn, the cold with all its accompanying inconveniences. Notwithstanding these difficulties, however, during the two years in which he was a member of the Boundary Commission, he accumulated materials for an elaborate and very valuable 'Report of the Geology and Resources of the Country in the Vicinity of the 49th Parallel,' accompanied with maps and many illustrations, which was published in Montreal in 1875. In connection with

this work he also prepared a report on the Tertiary Lignite Formation, a memoir on the 'Superficial Deposits of the Central Region of North America,' and papers on the 'Locust Visitations,' on the 'Fresh Water Sponges of Canada' and on the 'Fluctuations of the American Lakes.'

When the work of the Boundary Survey was brought to a close, he was appointed, in 1875, to the Staff of the Geological Survey of Canada, and, in 1883, on the retirement of Dr. Selwyn, he succeeded him as Director of the Survey, which position he held at the time of his decease. His field work, while connected with the Geological Survey, was carried on chiefly in British Columbia and the Northwest Territories, and the excellent character of this work contributed largely to the great development of the mining industry in these parts of the Dominion in recent years.

Dr. Dawson also rendered important public service in connection with the Behring Sea arbitration. As one of the British Commissioners he spent the summer of 1892 in the Behring Sea region, for the purpose of inquiring into the facts and conditions of seal life. The report of the Commission constituted the case of Her Majesty's Government, and I remember hearing at the time a high tribute paid to Dr. Dawson's ability by one of the gentlemen connected with the United States side of the case, in the statement that had it not been for Dr. Dawson's evidence and arguments, a finding much more favorable to the United States would probably have been secured. In connection with his services on this arbitration he was made a Companion of the Order of St. Michael and St. George (C. M. G.).

He usually enjoyed excellent health and had great capacity for hard work, but he succumbed very suddenly, on the 2d of March last, to an attack of acute bronchitis after an illness of but two days.

Dr. Dawson was a prolific writer. In addition to his numerous and voluminous official reports, he contributed many papers on geological, geographical and ethnological subjects to the scientific magazines and to the Transactions of various learned societies, both on this continent and in England.

He received the degree of D.Sc. from Princeton, and the degree of LL.D. from Queen's University in 1890 and from McGill University in 1891. In the same year he received the Bigsby gold medal from the Geological Society of London for his services to the science of geology, and was elected a Fellow of the Royal Society. In 1893 he was elected President of the Royal Society of Canada. In 1896 he was President of the Geological Section of the British Association for the Advancement of Science at its Toronto meeting, and was last year President of the Geological Society of America. His presidential address, delivered on retiring from the latter position, appeared in a recent number of SCIENCE. In 1897 he was awarded the gold medal of the Royal Geographical Society. He also received many other distinctions which cannot here be mentioned.

Dr. Dawson was a man of more versatile gifts than his father, but like him possessed of an unusual combination of scientific insight, literary ability and administrative capacity. He was a man of broad views, clear and judicial frame of mind, modest and retiring, but withal an excellent conversationalist. He won the esteem of all who knew him, and his loss will be keenly felt by his very large circle of friends.

FRANK D. ADAMS.

McGILL UNIVERSITY, MONTREAL.

---

*STATE NATURAL HISTORY SURVEYS.**

A GEOLOGICAL survey of Wisconsin, very complete and careful for the time, was com-

* Abstracts of addresses made before the Naturalists, meeting in Chicago, December, 1900.

pleted in the year 1878. During the following twenty years no investigations of this character were carried on in the State. In 1897, however, the Legislature organized the present Geological and Natural History Survey and gave to it for the first two years an appropriation of $5,000 annually, which was doubled during the second biennial period. The government of the Survey is in a Board of Commissioners, consisting of the governor of the State, the president of the State University, the State superintendent of Public Instruction, the president of the Commission of Fisheries, and the president of the Wisconsin Academy of Sciences, Arts and Letters. The director of the survey from the first has been E. A. Birge, professor of zoology in the University of Wisconsin. The work of the Survey has been done along three lines: economic, scientific and educational.

The first piece of work of economic importance was the investigation of the building stones of the State, to which two years were devoted by Dr. E. R. Buckley, who is in charge of this department, and, as a result, a full report on the building stones was published as a bulletin of the Survey in 1899. After the completion of this work, Dr. Buckley turned his attention to the clays and the clay industries, on which he is still engaged. A general report on this subject will appear during the present winter, and the work will be continued probably for at least a year or two in the future. The geological structure of the Keweenawan, or copper-bearing rocks, of Douglas and adjacent counties of northern Wisconsin has been worked out by Professor U. S. Grant, and a preliminary report has been published.

Of the several scientific investigations, the most important is the geology of the crystalline rocks in the central part of the State—a region which was almost entirely uninhabited at the time of the earlier survey. Its investigation has been assigned to Dr. S. Weidman, who has been carrying on field work since the organization of the Survey and who will prepare a complete report of the geology of the region when he has completed the task of working out, in the field, the difficult and intricate relations of the rocks.

Another line of work has been on the lakes which are so abundant in Wisconsin. A hydrographic survey has been made of more than 60 of the more important lakes in the southeastern part of the State, and maps of these lakes have been published. The investigation of the biology of the waters has been fairly begun. The physica geography of the lake region of southern and eastern Wisconsin is now being studied by Mr. N. M. Fenneman.

The first educational bulletin has recently been published by Professor R. D. Salisbury, on the physical geography of the region about Devil's Lake. This is intended to set forth the geography and the surface geology of the region in such a way as to bring out the principles of physical geography involved, so that the book will be primari ly of value to the teachers and students of the subject, but it is also a contribution to our knowledge of that region.

This brief notice touches only the most important directions in which the Survey has been working, leaving unmentioned many subjects to which less attention has been given.

So far as the experience of the Wisconsin Survey goes, it appears that the State is quite willing that a considerable amount of money should be devoted to investigations whose value is scientific in the fullest sense of the word, and it also expects a considerable amount of attention to be given to subjects of economic value and of immediate practical importance. This seems to me to be entirely right. The State has a right to expect an economic return for money expended in a State survey, especially as there are

subjects of economic value which demand immediate investigation and whose study is the duty of a survey. On the other hand, the Survey ought not to allow its attention to be directed to subjects of immediate economic interest only, since, as we all know, the pure science of the present becomes the applied science of the future, and it is eminently the task of the Survey to work for the future as well as for the present. The Wisconsin Survey has endeavored to fulfill both these requirements, so far as the means at its disposal would permit, and its efforts have been fully endorsed by the State.

E. A. BIRGE.

UNIVERSITY OF WISCONSIN.

THE Natural History Survey of Minnesota is being carried on in pursuance of an act approved in 1872, and entitled "An act to provide for a geological and natural history survey of the State and to entrust the same to the University of Minnesota." In accordance with this law the Board of Regents of the University at once appointed Professor N. H. Winchell geologist of the Survey and placed the work under his supervision. The funds for carrying on the work have been almost wholly derived from the sale of so-called 'State salt lands' set aside for the Survey. After about 20 years of good work by the geologist, the geological work has been ordered to be brought to a close and the natural history has been taken up, with the professors of botany and zoology in charge of the botany and zoology respectively.

The law creating this Survey is so broad in its scope that so-called purely scientific investigations are as incumbent upon those in charge of the work as the so-called economical. Accordingly we do not at present divide this work into scientific and economical problems, but try to do scientifically everything we undertake to do, whether it has an immediate practical bearing or not. Economical and practical questions are by no means neglected, and the plans at present being followed contemplate reports that will be of educational and scientific value, as well as a handy source of information to the citizens of the State.

On the zoological side the vertebrates are at present receiving the most attention. So far as possible complete accounts of certain more or less typical species, and species that for one reason or another are of special interest and importance, are being prepared in connection with the more general reports. These individual biographies, as they might be called, are intended to serve as guides and reference texts in the schools of the State. The invertebrates are not being neglected, though with the exception of one or two groups they are not receiving special attention at present. Plankton work can not be said to have received any serious consideration, and probably will not as long as more promising and less 'killing' fields are as plentiful as they are.

In reply to questions and suggestions, it was stated that both the botanist and zoologist made it a point to send their reports, not only to all the schools of the State, but so far as possible also to all the newspaper offices in the State.

An examination of Minnesota Plant Life, issued by the botanist of the survey, will convince the most skeptical that State reports can be issued in the best typographical style. This matter, however, demands special attention and experience.

In consequence of the close connection between the University and the Natural History Survey, the biological departments of the University have become the bureau of information on natural history questions for the entire State, and the professors of botany and zoology annually answer hundreds of letters—yes, in some years, thousands.

The matter of cooperation between the

surveys of the different States has come up frequently, but I am not sure that we are ready for any definite plans. It would seem that cooperation along some lines at least would lead to most valuable results, but how to adjust these so differently organized surveys is much more difficult than picking out the problems. I am inclined to believe that we shall have to go over our fields independently at first and look toward cooperation later on. In the meantime suggestions and discussions and reflection should not be set aside altogether.

H. F. Nachtrieb.

University of Minnesota.

It is to be regretted that Professor Forbes is necessarily absent from this meeting, since he only can adequately discuss matters connected with the Natural History Survey of the State of Illinois. It is to his energy and foresight that the Illinois State Laboratory of Natural History, which is charged with its accomplishment, owes its origin, some twenty-five years ago, and it is to his oversight and direction that its success is due.

The conditions affecting the biological survey of Illinois differ materially in several particulars from those existing in Minnesota and Wisconsin. Illinois has no State geologist nor State geological survey, so that from its beginning the biological survey has been free from some of the difficulties experienced in a few of the neighboring States.

In 1877 the Legislature established what is known as the Illinois State Historical Library and Natural History Museum, at Springfield, and the Illinois State Laboratory of Natural History, at Normal, Illinois, with Professor S. A. Forbes as its director. The State Laboratory was established with several functions to perform. The law provided that by it the museum at Springfield should be supplied with material illustrating the fauna of the State; that educational institutions and high schools should be supplied with material for instructional purposes; and besides these educational activities, a State survey of the animals and cryptogamic plants was to be carried on; and, finally, certain studies of an economic character were to be made with reference to the food of fishes and of birds. In 1883 the director was made State Entomologist, and for a number of years subsequently there was no sharp division between those operations of the State Laboratory carried on in connection with economic entomology and those for which the institution was originally established. In 1885 the State Laboratory was moved to Urbana in consequence of the appointment of its director to the chair of zoology in the University of Illinois. From 1883 to 1893 the Natural History Survey work was somewhat intermittent in character, but with the establishment of the Biological Station on the Illinois river, the work has been carried on continuously along the lines originally intended. The appropriations have in most cases been reasonably liberal, and have gradually increased from $3,000 per annum to nearly $10,000, aside from the appropriations for economic entomology. At no time has the State Laboratory had the backing of any scientific society or of any other association in any way helpful in securing legislative appropriations. It has at all times stood strictly on its merits and the value of the work accomplished, and its continual growth is due to the confidence which members of the Legislature have felt in the integrity of the director as a man, and in his energy and ability as a scientist.

The laws under which the State Laboratory was founded and has been supported seem to emphasize the educational part of its duties rather than the scientific and economic features. Professor Forbes's working definition of 'survey' involves more than a

mere census of animals and plants or a publication of lists showing local and geographical distribution. It is broad enough to include matters of an ecological character, and this view has largely determined the general plan of operations. It would have taken less time to send the material of the various collections to specialists at Washington, or elsewhere, and have identifications made by them, than to collect the necessary literature and allow the time and expense involved in the training of a group of specialists on the staff of the State Laboratory; but the former plan would have resulted simply in the accumulation of named material as a basis for lists of plants and animals with reference to local and geographical distribution, while the latter course is essential to a natural history survey in a wider sense. The director regards as one of the most important objects to be attained by the State Laboratory investigations, the presentation of the knowledge obtained in a form accessible to all interested intelligent citizens of the State. Much remains to be done before this work will be completed. Most of the literature thus far published by the State Laboratory has been more or less technical and written with reference to the specialist, but such material is to be considered as a sort of by-product incidental to the prosecution of the more essential duties.

Two important lines of work are now in progress. One of these, the ichthyological survey, has received much attention during the past two years and will result in the publication of a comprehensive report on all the fishes occurring within the borders of the State, in which as full an account as practicable of life histories, habits and conditions of environment will be given in addition to the ordinary descriptive matter. Each species is to be illustrated by colored plates made from living specimens. I have brought, for the inspection of those interested, a few of the drawings already prepared, which reflect great credit on the State Laboratory artist, Miss Lydia M. Hart, by whom they were made.

Another line of work which is being vigorously prosecuted is the study by Dr. Kofoid of the plankton material collected from the Illinois river at frequent intervals during a period of nearly five years. The work of counting has been completed, and the data are being got into proper form as rapidly as possible. As a result of this work much interesting and important knowledge is being gained concerning the life histories, seasonal distribution, relative numbers and sequence of succession of many of the minute organisms composing the river plankton. As most of the counting work has been done since Dr. Kofoid made a preliminary report in this place a year ago, I may mention that some interesting facts stated by him in a tentative way have been confirmed. For example: (1) the marked constancy in the seasonal recurrence of many species, with their maximum and minimum numbers appearing annually within narrow time limits—perhaps an adaptation to definite temperature conditions; (2) the constancy of a spring and fall maximum for many species, the latter secondary—these maxima indicating perhaps an adaptation to the mean temperature of the year; (3) the evidence of the extreme variability of some of the limnetic forms and the probable genetic connection within the season of a number of supposed species—as in the case of *Brachionus bakeri* and its related forms and of *Dinobryon*, composite colonies of the latter being often found, different portions of which are made up of very different types of individuals, types which more frequently will be found in small colonies of homogeneous character and which have received various specific names; (4) the presence of a minute plankton flora occurring within about the same seasonal limits

as the foliage of the trees and disappearing as abruptly. For the greater part these forms are so minute that they ordinarily escape the silk net, and it is only in collections made by some filter method that an adequate idea of their importance can be gained. Detailed examination of the filter-paper catches tends to confirm the criticisms of Dr. Kofoid with reference to the dependence on collections made by the silk net alone. The loss by leakage or escape is often volumetrically as well as numerically very large. Other interesting facts might be referred to, but there is scarcely sufficient excuse for it in this connection.

A paper of systematic character on the leeches of the State Laboratory collection, by Mr. J. Percy Moore, is now in press, and an article on the Odonata, by Professor Needham and Mr. Hart, is nearly ready for the printer. Aside from numerous publications of an economic entomological character there have been published two quarto volumes on the birds of the State, and five volumes of the *Bulletin of the Illinois State Laboratory of Natural History.*

As to future work, it is probable that a comprehensive entomological survey entirely distinct from economic investigations will be undertaken in the near future, and work is now in progress on the first one of a special series of bulletins of what may be termed an educational nature, in which the object will be to treat various groups of animals in such a way as best to meet the needs especially of teachers and students of zoology in high schools and colleges. These bulletins, while giving descriptions and synoptic keys, are at the same time to include such physiological and ecological matter as will make them useful. It is intended that they shall be scientific, but written for others than specialists.

While cooperation in the work of the various State surveys would theoretically have several advantages, it practically seems well-nigh unattainable because of the great difference in the conditions governing the action of each. Efforts have been made within the past few years to bring about such cooperation, but without result. If it were possible to have the energies of different surveys directed in part along similar lines of work synchronously, so that one specialist might work up a given group of animals for several States, there would be evident economy in time and money; or such special educational publications as those previously referred to might, with comparatively small additional outlay of time and money, be adapted to use in several States instead of but one. It might be greatly to the advantage of the surveys in different States if competent men in charge of the biological departments of some of the educational institutions of the State should become interested and responsible for the working up of special groups; and as far as Illinois is concerned, Professor Forbes would be greatly pleased if such cooperation between the State Laboratory and some of the working biologists in the State might be accomplished. He would willingly procure necessary literature and aid in the matter of collections, and although not ready to make unconditional promises of compensation, would, I am sure, feel warranted in cooperation of a financial, as well as of a scientific, sort. Here we meet with one of the great difficulties in the economical prosecution of such survey work. The instruction in our leading institutions is so exclusively along morphological and physiological lines that the men coming from such institutions are not prepared for the kind of work required in surveys, and much time and expense is involved before they can accomplish results. A vacancy on the State Laboratory staff is often a serious matter, because of the impossibility of finding men already prepared to prosecute such work.

Frank Smith.

University of Illinois.

THE TRAINING OF AN ELECTROCHEMIST.

AT the meeting of the German Electrochemical Society in Zürich, last August, Professor Richard Lorenz,* at the request of the Society, read a paper on the kind of training which is desirable for an electrochemist. The paper contains much which is suggestive in reference to the training of chemists in general, and calls attention to certain defects in the present method, especially as applied in many of the German universities.

Lorenz first raises the question as to whether electrochemists are entitled to recognition as representing a separate and distinct branch of science, and, notwithstanding the fact that they have not yet received such recognition in all the schools, answers the question, of course, in the affirmative. The battle in reference to the existence and recognition of electrochemistry is, in most places, at an end. Its chief enemy is the one-sided manner in which chemists, until recently, have been trained; and this one-sided method of training still obtains in some universities. We know, to-day 'that a chemical doctor well trained in all directions' is often nothing but a special organic chemist. Even if in some cases the candidate has learned a little analytical chemistry in order to be able to pass certain examinations outside of the university, he knows absolutely nothing of that fundamental branch of science—physical chemistry—and his knowledge of inorganic chemistry is so fragmentary that it cannot be called scientific—of the science of inorganic chemistry he knows essentially nothing.

It is quite different at certain polytechnic institutions where inorganic chemistry is constantly introduced in connection with technical chemistry and metallurgy.

Since electrochemistry, as is well known, is one of the best developed branches of physical chemistry, the electrochemist should be trained in physics and in chemistry. Organic chemists should also know much more physics than is usually required of them.

Electrochemistry is also very closely connected with inorganic chemistry, and the rise of physical chemistry and electrochemistry in Germany has reawakened an interest in inorganic chemistry, which had almost entirely disappeared. Modern electrochemistry is an exact science, and rests on a mathematical basis. Every electrochemist must, therefore, be trained in the elements of the higher mathematics, and be able to use the differential and integral calculus. Later he must apply thermodynamics and chemodynamics to the problems as they arise. It is not until mathematics is applied to special problems that its significance is appreciated by the investigator of nature.

It is difficult to lay too much stress on the importance for an electrochemist of a general training in physics. He should be trained first of all in mechanics, then in sound that he may become familiar with the conception of wave-motion, also in heat, light, electricity and magnetism.

The physicist, in training a skilful electrochemist, should not ask "What use can he make of my knowledge?" and he should not adapt his teaching to special needs. The electrochemist, as well as the practical chemist, can use all physics. They may have to do with the magnetic properties of the atoms, or with heat phenomena, or with photometric relations, or with the kind and nature of the vibrations in an ozonator, or with fusion, evaporation and specific heats in the electric furnace. If the physicist were to consider simply the 'needs of the electrochemist,' he would teach him simply the chapters which pertain to electrical measurements. This would be a serious error and would retard the development of electrochemistry along broad

* *Ztschr. elect. Chem.*, 7, 201.

and general lines. The need of the electrochemist is for the broadest possible development in the science of physics.

Analytical chemistry is of fundamental importance for the electrochemist. He should be able to make more or less complex analysis not only accurately, but rapidly. Speed in carrying out an analysis is often a necessity.

Inorganic chemistry is still taught but little at the German universities, and this is, of course, fundamental for the electrochemist. Some little inorganic chemistry is taught under the head of 'general chemistry.' In other places some lecture experiments are shown, and equations written, showing the transformations of substances. In other places inorganic chemistry is dealt with from the standpoint of the modern theory of ions. But in the last decade inorganic chemistry has developed as rapidly and made as great strides as theoretical chemistry. Thus, the vast amount of knowledge which we have in reference to the formation and decomposition of double salts, the beautiful experiments in the field of complex compounds, the extension of our science to the rare gases and rare earths, the reactions of substances at high temperatures as studied by the French school, the transformation temperatures and, finally, the fundamental relations of all phenomena to the Periodic System, are seldom dealt with. We need a place in which these matters can be *really systematically discussed* and brought to their attention. We should teach the students fewer formulas and more about the *real knowledge of the properties of all the elements and compounds.*

We know from the lectures of Van't Hoff on 'The Increasing Importance of Inorganic Chemistry,' and of Hittorf on 'The Necessity of Establishing Special Chairs for Inorganic Chemistry in the German Universities,' that the chairs of inorganic chemistry have been occupied almost exclusively by organic chemists, whose interest and indeed whose knowledge were not in this field. As co-editor with Küster of the *Zeitschrift für anorganische Chemie*, I have had the very best opportunity to observe how great has been the growth in this field. If any one should think that the reason for desiring new chairs of inorganic chemistry to be established is in any way connected with the desire that certain individuals should have full professorships in inorganic chemistry, he has not obtained his information from the proper source.

In reference to the training of the electrochemist in organic chemistry, that is already amply provided for, and nothing further need be said concerning it. The electrochemist should also study as subordinate subjects mineralogy, crystallography, geology, etc.

Lorenz then takes up the question as to how far the electrochemist should be familiar with mechanics, a knowledge of machines, mechanical drawing, etc. He recognizes the force of Ostwald's warning, that the student should not have too many subjects, but under present conditions electrochemists, in out-of-the-way places, may have to fill so many rôles that a knowledge of these mechanical matters is often a necessity.

In reference to the special electrochemical training; instruction should be given, as Knorre has already pointed out, in general and technical electrochemistry, in general physical chemistry, as well as in thermochemistry, chemical dynamics, organic electrochemistry, chemical thermodynamics, etc. The student should be so trained in mathematics that these subjects can be dealt with mathematically. The best means to train and develop an electrochemist, in general, is the carrying out of a scientific investigation, as Ostwald has already maintained.

Lorenz then takes up the discussion of

the work which should be done by the electrochemist in the laboratory, and finally decribes the training which the students in the Polytechnic Institute in Zürich receive. The point which is of chief interest here is that *mathematics is required for every chemist*, and physics is introduced in the broadest way into the course of every chemist.

The scientific importance of this address is much greater than would be implied by its title. The question arises whether much that was said by Lorenz does not apply to other branches of science or, perhaps, to all, although it is true that some of the natural sciences, chiefly on account of the relative complexity of the phenomena dealt with, are not yet sufficiently advanced to enable the mathematical methods to be extensively applied to them, yet they are all rapidly approaching that stage which we may describe as the mathematical.

Take as an example the science of chemistry. Physics, the furthest developed of all the natural sciences, has long since become an exact or mathematical science. It has been only a short time since a student could get on fairly well in most branches of chemistry without any knowledge of the higher mathematics. But how different to-day? A chemist now who is not familiar with the calculus can have no adequate conception of the theoretical side of his science, as Van't Hoff and others have repeatedly pointed out. In inorganic chemistry, at least in its latest developments, the calculus is absolutely essential, since inorganic chemistry is touched at all points by physical chemistry, and who can know anything of physical chemistry without the calculus. Take on the other hand organic chemistry. There are certain very important phases of this subject into which the higher mathematics has not yet entered; but in the study of the velocity of organic reactions, of the chemical dynamics and statics of such reactions, not only the calculus is required, but also a fair knowledge of thermodynamics. In physical chemistry a knowledge of the higher mathematics and of physics is just as essential as a knowledge of chemistry itself, and thus it goes through the whole field of chemistry.

A student who starts out to-day to become a chemist without a good knowledge of physics and mathematics is hopelessly handicapped at the outset, no matter to what division of chemistry he may turn his attention.

In other branches of science we already see the dawn of the exact or mathematical period. Take physiology, one of the most complex of the biological sciences. Certain phenomena of life have already lent themselves to mathematical treatment, as is shown by the work of Loeb and others. The application of physical chemistry to physiology seems to mark the introduction of the mathematical method in dealing with the physics and chemistry of life.

Take morphology—the work of Davenport shows that even structure can be treated by the exact method, and makes it probable that the morphologist in the future will have to look to his higher mathematics.

Other branches of science might be cited, but these suffice to show how rapidly the mathematical method is coming to be applied to all scientific knowledge. *Perhaps the most distinguishing feature of scientific study at the beginning of the twentieth century is the introduction of the mathematical method into all those branches of knowledge which are sufficiently developed.*

One of the most important features, therefore, in scientific training to-day is a thorough course in the elements of the higher mathematics, and this should be followed in every case by an equally thorough course in physics. The student who is not thus equipped can never hope to pass

beyond empiricism, nor obtain any insight into the real meaning and relations of natural phenomena.

HARRY C. JONES.

---

*APPROPRIATIONS FOR THE U. S. DEPARTMENT OF AGRICULTURE.**

THE passage of the agricultural appropriation act for the year 1901–1902 marks an epoch in the history of the development of the national Department of Agriculture. Not only does it carry the largest appropriation ever made for the Department and provide for future extension of its work in various lines, but it inaugurates a scheme for the partial reorganization of the scientific branches of its work. Three of the present divisions are raised to the grade of bureaus, and a number of other divisions are associated in one large Bureau of Plant Industry, corresponding in a general way to the present Bureau of Animal Industry.

Starting first as an appendix to the Patent Office for the distribution of seeds, the Department of Agriculture was formally organized in 1862 as an independent department in charge of a commissioner, and in 1889 was raised to the dignity of an executive department. The passage of the Hatch Act providing for agricultural experiment stations about that time increased its responsibilities and extended its field of usefulness.

The growth of the Department has been steady and uninterrupted. The importance of its work has been recognized by steadily increasing appropriations, and the relations maintained with the experiment stations furnish a means of carrying its investigations into every section of the country, in cooperation with these institutions, and serve to broaden its influence. As an institution for agricultural investigation it is now without a counterpart in any country, and there are few, if any, scientific institutions which include so large an aggregation of scientists and experts devoting their attention to investigations and research. The Department is coming to be generally recognized as one of the great scientific institutions, not alone in this country, but of the whole world. The formation of bureaus is a fitting step at this juncture, for it is a recognition of the growth which has been made and the need for a more compact form of organization. The creation of these four new bureaus, in addition to the Weather Bureau and the Bureau of Animal Industry, is a following out of the general divisions into which the subject of agriculture seems logically to fall, associating such lines of work as relate closely to each other and providing for the closest cooperation practicable among them.

The new Bureau of Plant Industry embraces the divisions of Botany, Vegetable Physiology and Pathology, Agrostology, Pomology, and Gardens and Grounds, and is under the directorship of B. T. Galloway. To this bureau has also been assigned the Section of Seed and Plant Introduction, together with the general supervision of the experiments in tea culture. A horticulturist will be added to the list of specialists, with the intention of developing the work of investigation along that line. From the standpoint of administration the arrangement will be an economy of time and will give greater opportunities for investigation to the chiefs of the divisions.

In recognition of the plan for a systematic survey of agricultural soils and for extension of the work in forestry, the divisions of Soils and Forestry receive bureau organizations and are raised to that designation. The fourth bureau provided for is the Bureau of Chemistry, to which additional scope will be given.

* From proofs of the 'Experiment Station Record,' Vol. XII., No. 9.

The appropriation act makes frequent mention of cooperation between the different divisions of the Department and also with the agricultural experiment stations. The establishment of the Bureau of Plant Industry will favor the extension of the cooperation and will assist in adjusting the lines of work and preventing any tendency to duplication.

Of the new bureaus the Bureau of Plant Industry receives the largest appropriation, namely, $231,680. The amounts appropriated for the different lines of investigation in charge of this bureau, aside from certain salaries, are $60,000 for investigations in vegetable pathology and physiology, $20,000 for pomological investigations, $45,000 for botanical investigations and experiments, $20,000 for grass and forage plant investigations, $20,000 for seed and plant introduction, $7,000 for tea-culture experiments (an increase of $2,000), and $20,000 for gardens and grounds. The total appropriation for the Bureau of Plant Industry represents an increase of $61,900 over the combined appropriations for the previous year of the divisions associated in it. A new feature of the botanical investigations is the study of useful plants of the tropical territory of the United States, together with plants likely to be of value for introduction into those sections. Furthermore, investigations are to be made on 'the varieties of wheat and other cereals grown in the United States and suitable for introduction, in order to standardize the naming of varieties as a basis for experimental work of the State experiment stations and as an assistance in commercial grading'; and in cooperation with the Bureau of Chemistry, the cause of deterioration of export grain, particularly in oceanic transit, is to be investigated, together with means of preventing such loss. Special mention is made in the appropriations for this bureau of the employment of scientific aids, a class of employees drawn from the agricultural colleges, which has previously been arranged for in the Department.

The Bureau of Forestry receives $185,440, an increase of $105,440 over the previous year. The appropriation for the Bureau of Soils is $109,140, which is an increase of $77,840. This is to enable an extension of the tobacco investigations, which remain in charge of this bureau, and the investigation and mapping of soils in the United States. The Bureau of Chemistry receives $35,800, and in addition to its other duties is charged with the investigation of food preservatives and coloring matters 'to determine their relation to digestion and to health and to establish the principles which should guide their use.'

The Weather Bureau receives increased appropriation for general maintenance, and $46,000 for the erection and equipment of buildings in six different places, and for laying a cable between the mainland and Tatoosh Island, Washington, making the total appropriation $1,148,320. The maintenance fund of the Bureau of Animal Industry is increased $50,000, and the inspection work is extended to include dairy products intended for exportation to foreign countries. Such products, the same as meats, may be marked, stamped or labeled, so as to secure their identity and indicate their purity and grade. This is an entirely new provision, which it is hoped will tend to place American products on a better footing in foreign markets. An appropriation of $25,000 is made, in addition to one of $50,000 last year, for animal quarantine stations, giving a total for the bureau of $1,154,030.

The appropriations for agricultural experiment stations have reached the sum of $789,000, including $33,000 for the Office of Experiment Stations, as heretofore, and $12,000 each for stations in Alaska, Hawaii and Porto Rico. The Hawaii station

will be located near Honolulu on a government reservation originally set apart by the provisional government for the use of an experiment station. It is intended to make the work there supplementary to that of the experiment station which has been maintained by the Hawaiian sugar planters, and attention will be given to other field crops and the development of animal industry and horticulture. Jared G. Smith, recently in charge of the Section of Seed and Plant Introduction of this department, has been placed in charge of the Hawaii station, and will take up the work there about the middle of April. Fifty thousand dollars was appropriated to continue the irrigation investigations, and $20,000 for nutrition investigations, the latter being an increase of $2,500.

The Division of Statistics receives $156,160, the same as last year, the Division of Entomology $36,200, and the Division of Biological Survey $32,800. The fund for publications is increased by $50,000 for farmers' bulletins and a small amount for distribution, making the total for the Division of Publications $198,020 aside from the general printing fund, $110,000. Other appropriations are as follows: seeds, $250,000, exclusive of the $20,000 mentioned for seed and plant introduction, an increase of $100,000; library, $16,000; public-road inquiries, $20,000, an increase of $6,000; investigating the production of domestic sugar, $5,000; Arlington farm, $10,000; office of the Secretary, $71,670; Division of Accounts, $18,900; Museum, $2,260, and contingent expenses, $37,000. The grand total, including the regular appropriations for the experiment stations, is $4,582,420, an increase of $558,920 over last year.

An important item of the appropriation act is the authorization of the Secretary of Agriculture to submit plans and recommendations for a fireproof agricultural building, to be erected on the grounds of the Department, and appropriating $5,000 for the preparation of such plans. The Department long since outgrew its original accomodations, and for years has been badly cramped for room. The present main building has been condemned as unsafe, and from the nature of its construction the risk of fire has always to be met. Besides erecting a number of small buildings, which are mere temporary makeshifts, it has been necessary to rent several residences in the neighborhood and adapt them to laboratory and office purposes. Laboratory buildings for the Division of Chemistry and the Bureau of Animal Industry have been specially erected by private parties and rented to the Department. The amount now paid for rental for these buildings, together with the additional expense required for watchmen, aggregates about $10,000 annually. The position to which the Department has now attained, the demands of its work, and the safety of its library records and collections, make a modern agricultural building a practical necessity if not an imperative need.

E. W. Allen.

THE REDUCTION TO ABSURDITY OF THE ORDINARY TREATMENT OF THE SYLLOGISM.

The traditional treatment of the syllogism errs both by redundancy and by insufficiency—that is to say, the validity of the syllogism can be tested by a far simpler method of procedure, and, on the other hand, the ordinary method fails of application to a vast number of pairs of propositions which are nevertheless the premises of a valid syllogism. In the first and second moods of the first figure the syllogism is in what may be called its primitive form—it is doubtless the only form in which it is used by children and savages; but there is another form, in which negative modes of expression are given free play, which is far

superior to it in facility of manipulation. This superiority has its source in the fact that of the eight (not four, to which the ordinary logic has reduced the forms of speech) propositions necessary to a complete description of the universe,—

a. all *a* is *b*,	$\bar{a}$. not all *a* is *b*,
$\bar{u}$. none but *a* is *b*,	*u*. some besides *a* is *b*,
$\bar{\imath}$. no *a* is *b*,	*i*. some *a* is *b*,
o. all but *a* is *b*,	$\bar{o}$. not all but *a* is *b*,

it is the last four that possess the great advantage of being symmetrical (that is, of having subject and predicate amenable to the same rules of manipulation), and of these it is 'no *a* is *b*' and 'some *a* is *b*' that possess the other advantage of naturalness. These last should therefore be regarded as the canonical form of the proposition; and correspondingly, the ideal form of the syllogism is that in which it appears as a statement of the impossibility of concurrence of the premises and *the denial of the conclusion* of the ordinary syllogism. The canonical form of the syllogism is therefore this:

no *a* is *b*,
no *c* is non-*b*,
and some *a* is *c*

are inconsistent (*or cannot all three be true together*). This may be called the Inconsistency, or the Incompatibility, or, perhaps, the Antilogism. But in this all three propositions play an exactly similar rôle—there is no distinction between premises and conclusion, and it is therefore the one single form to which *every* syllogism may be at once reduced, provided we (1) express every universal proposition in the negative form, no *p* is *q*, (2) express every particular proposition in the affirmative form, some *r* is *s*, and also (3) deny the conclusion. When thus reduced to the form of an inconsistency, the rule for validity is this: of the three propositions, two are universal and one is particular; each two propositions have one and only one term in common; the term common to unlike propositions appears with like signs and the term common to like propositions appears with unlike signs. (Thus in the above typical form, *b* and non-*b* are common to the two universal propositions, but *a*, or *c*, of like quality, are common, respectively, to the particular and either universal.)

Any given statement of fact may be expressed in terms of any one of the four different copulas given above, or again, with the aid of the special terms *the non-existent* and *the existent* (0 and ∞ in Symbolic Logic), it may be expressed in four different ways with one and the same copula; thus

all *a* is *b*,	nothing is *a* and $\bar{b}$,
all $\bar{b}$ is $\bar{a}$,	everything is $\bar{a}$ or *b*,

are four different forms of one and the same statement of fact (expressed in the four possible combinations of two terms and their negatives); but in the two symmetrical copulas (no *a* is non-*b*, all but non-*a* is *b*)* the four forms all become practically identical. There are therefore ten $(4 + 4 + 1 + 1)$ essentially different ways of saying one and the same thing. As each proposition of the Inconsistency can be expressed in any one of these different ways, and again as each Inconsistency can appear in the form of the universal or of the particular syllogism, the total number of possible syllogisms (when full latitude is given to mode of expression) is two thousand $(10 \times 10 \times 10 \times 2)$. An example of one of these outlying forms is this: none are athletic and unhealthy, none are healthy and unhappy, hence all are either

* It is, to a certain extent, matter of taste whether

no *a* is b,	nothing is both *a* and *b*,
no *b* is *a*,	*a* which is *b* is non-existent,

be regarded as different forms or not,—and so 'all but *a* is *b*,' etc. If it be preferred to consider them as different, then the entire number of propositional forms is 16 instead of 10 and the number of different syllogisms is $16 \times 16 \times 16 \times 2 = 8192$.

happy or non-athletic. Any one of these two thousand forms can be at once tested as regards its validity by the above 'Rule for the Inconsistency.'

Christine Ladd Franklin.

AMERICAN CHEMICAL SOCIETY.

The American Chemical Society will celebrate the 25th anniversary of its foundation in the city of New York, on Friday and Saturday, April 12th and 13th. Prominent chemists from every portion of the United States are expected to participate in the festivities which include a presentation of the history and achievements of the Society, its present scope of work and influence and a general review of the progress of chemical science in this country during the past twenty-five years. The present condition of the science of chemistry will also be shown, and the extent of its applications to the various industries.

The American Chemical Society is an outgrowth of a meeting of American chemists held in Northumberland, Penn., August 1, 1874, to celebrate the centennial of the discovery of oxygen by Sir Joseph Priestley. The large body of eminent chemists there assembled believed that the time had come for the formation of a permanent society, which should be representative of American chemists and their work, as the foreign chemical societies are of the chemists of their respective countries.

It was not until the year 1876, however, that this idea took definite form in the establishment of the American Chemical Society. In the early part of that year the Society was organized, and in 1877 it was incorporated under the laws of the State of New York.

The first president was that distinguished chemist and physiologist, Dr. John W. Draper, of the City of New York, whose researches in spectrum analysis and pioneer work in the production of the daguerreotype and photograph will never be forgotten.

From the beginning the Society has published regularly a journal of its proceedings, including papers and discussions. Many of the leading chemists of this country have been enrolled in its membership; prominent chemical manufacturers have been among its associates; and not a few of the names of foreign chemists of distinction have been upon its roll, either as active or as honorary members.

About ten years ago very radical changes were effected in the methods and operations of the Society, and the results that have followed have proved the wisdom of the steps thus taken. The important features of the present plan of organization and operation are as follows:

1. Local sections are established in different parts of the country, and the presiding officers of these sections constitute the vice-presidents of the Society.

The following is a list of these local sections up to date: Rhode Island, Cincinnati, New York, Washington, Lehigh Valley, Chicago, Nebraska, North Carolina, Columbus, North Eastern (headquarters in Boston), Philadelphia, Michigan and Kansas City.

2. The general management of the Society is entrusted to a broadly representative council which includes all the past presidents of the Society, one or more representatives from each local section and twelve councilors elected by the membership at large.

3. Two general meetings of the Society are held each year in different localities with a view of increasing interest in the Society and stimulating activity among the chemists in various sections of the country by bringing them into closer acquaintance with one another and into a knowledge of the various interests with which they are connected. The summer meeting is held with that of the American Association for the Advancement of Science, and the win-

ter meeting, which is the annual meeting of the Society, is held at some convenient point during the last week in December. The winter meeting of 1900 was held in Chicago last December. The Society will hold its next summer meeting in Denver, Colorado, August 26 and 27, 1901.

4. The *Journal* of the Society appears on the first of each month during the year. It has been greatly enlarged during the past decade, and every effort is put forth to make it worthy of the Society which it represents. It contains papers read before the various sections of the Society and in its general meetings, together with such abstracts relating to the progress of chemical science and industry, as seem desirable. The estimate in which the *Journal* is held in other countries is shown by the number of articles published in the *Journal* which are fully abstracted or copied entire by foreign periodicals.

The present officers of the Society are: *President*, F. W. Clarke, chief chemist, U. S. Geological Survey, Washington, D. C.; *Vice-Presidents*, the presiding officers of the various sections; *Secretary*, Albert G. Hale, Brooklyn, N. Y.; *Treasurer*, Albert P. Hallock, New York; *Editor*, Edward Hart, Easton, Pa.; *Librarian*, Edward G. Love, New York. The officers of the New York local section are: *Chairman*, Professor C. A. Doremus, College of the City of New York; *Vice-Chairman*, Professor M. T. Bogert, Columbia University; *Secretary* and *Treasurer*, Dr. Durand Woodman.

The total membership of the Society is about 1800, distributed mainly throughout the United States and other portions of the American continent. Some of its members are to be found in Cuba and other islands of the West Indies, others in various European countries, South America and Australia; in fact nearly every nation of the world is represented in its membership.

It is believed that this celebration, with its record of the history and achievements of the Society, and its representation of the character and strength of the organization of American chemists whom it represents, will not only mark an epoch in the progress of the Society itself, but will point the way to higher attainments and greater triumphs in all departments of chemical science and its applications in the New World.

SCIENTIFIC BOOKS.

Sur quelques microorganismes des combustibles fossiles. Par B. RENAULT. One vol., roy. 8vo, pp. 460, with 66 text figs.; atlas, folio, 30 plates with explanation sheets. Extrait du Bulletin de la Société de l'Industrie Minérale. Troisième série, tome XIII., 4e livraison, 1899. Tome XIV., 1re livraison, 1900. Saint-Etienne. 1900.

This is a superb work on a very difficult, but at the same time very important subject both for the geologist and the biologist. It has been many years in process of elaboration, and more than a dozen preliminary papers, dating back as far as 1892, announcing important results as fast as they were reached, have appeared by the same indefatigable investigator, mostly unaided, but also occasionally in association with MM. Bertrand and Roche, who are working somewhat along the same lines.

It is fashionable in our day to extol the wonders of the microscope, especially so since the modern bacteriological investigations began with their momentous practical consequences. The medieval philosophers had not probably any adequate conception of the real meaning of their fine alliterative phrase: *Deus magnus in magnis, maximus in minimis.* Spencer's 'soul of truth in things erroneous' also finds exemplification here, for the 'devils' of which men were once believed to be 'possessed,' in disease, epilepsy, insanity, etc., and which it was sought to 'cast out' by exorcism and prayer, have been shown by the microscope to be real living things—malignant spirits—the invisible germs of disease.

But while it has become clear that these modern revelations have not brought anything new to light, and that these devils were as numer-

ous, as rampant, and as malignant in biblical times as they are to-day, it is only quite recently that the world has gained any conception of their enormous antiquity, and if any one ever supposed that their chief mission was to punish man for his sins, the fact, now made clear by this and kindred investigations, that they existed in equal numbers and in all parts of the world in Tertiary, Secondary, and even Primary time, *i. e.*, ten to fifty millions of years before man made his appearance on the globe is calculated to shake that belief. The microscope, which has so wonderfully illuminated the hidden mysteries of the present and the invisible world in which we live, has now been leveled at the past and brought to bear upon that vast and hoary antiquity of which we could scarcely form a conception even if we were able to express it in terms of our chronology.

In this work M. Renault treats the microorganisms of past ages under eight different heads, chiefly in the descending order of their occurrence in geologic time, viz., 1st, those found in peat beds of recent origin; 2d, those found in lignite beds, chiefly of Tertiary age; 3d, those found in certain modern bituminous schists; 4th, those found in the so-called boghead formations; 5th, those found in cannel coal; 6th, those found in true coal of the Carboniferous formation; 7th, those found in certain ancient bituminous schists; 8th, those found preserved in flint or silica, chiefly of Carboniferous age.

Peat may be called coal in the making, and consists almost entirely of vegetable matter that has accumulated, often to considerable thickness, where this matter has undergone prolonged maceration. The bulk of it is formed of the remains of the plants that grew on the spot, and which, either from the weight of this constantly increasing superincumbent mass, or from other causes, slowly sink and become buried by successive renewals of the same materials. It takes place in marshes or swamps kept perpetually wet or submerged, under which conditions certain plants long retain their vegetable substance. Many of them, especially dicotyledonous leaves and certain mosses, are thus often preserved permanently, and from their remains much may be learned of the flora of the period at which the peat was formed. Certain seeds are also well adapted to permanent preservation in peat, and it is only recently that extensive investigations of the peat beds of northern Europe have been undertaken by this method. Mr. Leo Lesquereux published in 1844 the results of extensive researches made by him on the peat bogs of the Jura Mountains and Central Europe, and Axel Blytt, Nathorst, Andersson, Sernander, Munthe and others have thoroughly studied those of Scandinavia and other northern regions, while Mr. Clement Reid has in this way successfully worked out the problem of the origin of the British flora. Besides impressions of mosses, and of leaves and stems, and the numerous seeds of spermatophytes found in these beds, the siliceous spicules of many genera and species of diatoms have been detected and systematically treated.

But M. Renault has availed himself of the higher powers of the microscope and has made known to us a large number of other forms of microscopic life. The Bacteriaceæ are found abundantly in the peat of Fragny and Louradou in France, and he has illustrated species of *Bacillus*, *Micrococcus*, *Streptococcus*, *Cladothryx*, etc. The mycelium of numerous fungi also occur.

The principal lignites studied for this monograph have been those of Hérault in the Department of Ain, of Saint-Martin-du-Mont (Ain), of Célas, and Durfort (Gard), and of Sainte-Colombe (Yonne). The first of these, which are Eocene in age, yielded both animal and vegetable forms; Infusoria of the genera *Aspidisca*, *Cinetoconia*, *Ploesconia*, *Vorticellina*, etc., the conidia of fungi referable to the genera *Helminthosporium* and *Macrosporium*, and the mycelium of species of *Morosporium*. Diatoms also occur (*Frustulia*) and Micrococci. The other lignites from localities in France were less fruitful but contained some of the same forms. Besides these, however, M. Renault examined material from Vicenza in Italy and from Coronel in Chili. The latter especially was found to be rich in conidia of the genus *Helminthosporium* and in amœboid forms of the radiate type (*Orbulinella*, *Hedriocystis*, *Clathrulina*).

As an appendix to the treatment of the lignites the author has introduced the results of his investigation of a certain curious fossil combustible from the Lower Carboniferous (Culm) of Tovarkowo and Malevka in Russia, Government of Toula. It consists chiefly of the bark or cuticle of the ancient lepidophyte called *Bothrodendron*, which M. Renault considers distinct from *Lepidodendron*. M. Zeiller has carefully studied this form from the same localities, but the interesting point brought out by Renault is the presence over the whole surface of these paper-coal cuticles of bacteria (*Bacillus*, *Micrococcus*), of which a number of species are figured and described.

The bituminous schists studied for this monograph also proved rich in the remains of extinct microscopic life. Those of Menat, of Oligocene or Aquitanian age, and carrying dicotyledonous leaves of the genera *Planera*, *Liquidambar*, *Cinnamomum*, *Persea*, etc., yielded microscopic fungi (*Helminthosporium*), diatoms (*Amphora*), etc. Those of the Bois d'Asson in the basin of Manosque, of Tongrian age, revealed the presence of Amœboids (*Dactylodiscus*), fungi (*Helminthosporium*, *Macrosporium*, *Sirodesmium*) and diatoms (*Fragilaria*). Some much older schists (Upper Lias) from Anina in Hungary were found to contain fossil algæ resembling the Permian genus *Pila*, also species of fungi of the genera *Mucedites* and *Morosporium*.

The bogheads have formed the object of M. Renault's studies for many years. He has made the beds of Autun, his native city, celebrated by earlier researches. In the present work he has greatly extended his investigations and dealt with similar material from various parts of the world. The bogheads result from the accumulation at the bottom of chiefly Permian lakes of an enormous quantity of microscopic algæ, which were probably gelatinous. In the process of deposition, maceration, and entombment their composition was greatly modified by various influences, among which bacteria played a part. The most important of the algæ forming the bogheads of Autun was the *Pila bibractensis*, named by Bertrand and Renault in 1892. In the present paper the evidence of the agency of bacteria in causing the fermentation of the algoid mass is fully presented and the Micrococci are shown in varied forms.

In specimens of a similar character from the Permian of New South Wales found overlying the coal beds, and probably of Lower Permian age, there occurs another genus of algæ which has been named *Reinschia* for Paul F. Reinsch, a German investigator and pioneer in this branch of research. This same genus recurs in the bogheads of the Transvaal at Ermels. The Torbanite of Torbane Hill, Fifeshire, Scotland, which was the subject of a celebrated lawsuit over the question whether it could be classed as coal, and in which it was at last legally so classed, is treated by M. Renault as virtually a boghead, and yields a species of *Pila* (*P. scotica*). Crushed macrospores of this alga occur along with the globular thalli, and bacteria, although more difficult to find than in other bogheads, have been discovered, consisting of masses of Micrococci. The bogheads of Armadale in Linlithgowshire, Scotland, are formed of various gelatinous algæ, among which another new genus (*Thylax*) is represented.

Among the numerous samples of American cannel coal which I was instrumental in having sent to M. Renault many years ago, and which he has carefully studied, there are some that he classes with the bogheads, especially those from Beaver Dam, Ohio County, Kentucky. These consist chiefly of the remains of a species of *Pila* (*P. kentuckyana*), whose isolated globular thalli form groups of eight or ten and are not disposed in bands. Bacteria are visible in the interior of the thalli.

The coal-bogheads of Alexandrewski, Kourakino and Murajewnja, in Russia, coal basin of Moscow, have a lignitoid appearance, and contain, besides a new species of *Pila* (*P. Karpinskyi*), a new genus, *Cladiscothallus*, with a much branched, discoid thallus. Adhering to the walls and penetrating the interior pulpy mass of *C. Keppeni* is a peculiar *Micrococcus*, which M. Renault has named *M. petrolei*.

The passage from bogheads to cannel coals is a short step, although these last usually belong to the Carboniferous period. They contain, however, to a considerable extent, the same flora

and fauna. In the so-called Bryant cannel of England, M. Renault finds the *Pila scotica*, of Torbane Hill, with macrospores and affected with bacteria. Here occur filaments of a fungus which he calls *Anthracomyces*. The mycella invade the covering of the spores of the algæ. They are very fine but distinct under a high power (1000/1), and susceptible of clear illustration. Other cannels of the Old World present substantially the same features.

M. Renault has carefully studied the specimens of cannel coal sent him from America and the results are interesting. The specimens represented many localities in West Virginia and Kentucky, and the names he gives are: Cannelton and Davis Creek in West Virginia, and Beaver Dam (mentioned above), Little Laurel Creek, Natz Creek, Hunnewell, Georges Branch, Caney Creek, Blackwater Creek, Mercer Station, Magofin County and Buena Vista in Kentucky. Those of Beaver Dam and Little Laurel Creek he classes as bogheads, the rest he regards as true cannels. The Cannelton specimens are filled with spores of ferns and lycopods, the walls of which have Micrococci disseminated through them. Algæ are rare in most of the American material except that of the boghead type, but in that from Davis Creek, classed as cannel, they occur, and belong to the above-mentioned genus *Cladiscothallus*. The species, however, is not the same as that of the Russian bogheads, and M. Renault has done me the honor to name it *C. Wardi*. It is discoid and spread out in a single plane with numerous dichotomous branches. It does not seem to be affected with bacteria. The specimens from Buena Vista, Kentucky, are wholly destitute of algæ.

In the coal basin of Commentry, in central France, which has yielded such a magnificent flora and great numbers of insects, and which I had the pleasure of visiting in September last, there is at the Puits Forêt a combustible mineral substance substantially representing cannel coal. It has yielded to M. Renault's microscope a considerable number of organized bodie, consisting of spores of ferns and Equisetaceæs but no algæ. He also finds the macrospore of *Sphenophyllum* and pollen grains of gymnosperms, wood of *Calamodendron*, and transverse sections of leaves, probably of *Cordaites*. Throughout the mass are everywhere distributed numerous Micrococci, on the surface of the membranes of the spores, and pollen grains, in the fragments of indeterminable vegetable matter and in the general matrix. Similar conditions obtain in certain barren measures at Rive-de Gier in the basin of Saint-Étienne, Upper Loire.

M. Renault treated many specimens of carbonized wood from the coal measures of Zsily, Hungary, Bouble near Saint-Éloi (Puy-de-Dôme) and Decazeville in France, and found them more or less permeated with bacteria (*Micrococcus Carbo*, *Bacillus colletus*, *Cladothryx Martyi*). He also found filaments of saprophytic fungi.

The coprolites and certain fish bones and scales of the bituminous schists of Autun, Igornay and Lally proved a rich field for the microscope, large numbers of Micrococci, bacilli and fungi (*Mucedites*, *Anthracomycetes*) from these sources being illustrated in this work.

A still richer source of fossil microorganisms is the various Paleozoic flints that occur in certain coal basins and other deposits. It was from such that Brongniart described so many remarkable seeds and fruits of Carboniferous plants, chiefly from the basin of Saint-Étienne. They contain all manner of vegetable tissues, and M. Renault finds these permeated with bacteria and fungi. The silica has preserved everything with great exactness and the illustrations of microscopic organisms in this matrix are much clearer than those from the fossil combustibles. Some of these are older than the coal measures and are found in the Culm and even in the Devonian, as those of the Cypridine schists of Saalsfeld, in which silicified remains of *Cordaioxylon* are affected by a *Micrococcus* (*M. devonicus*). At Estnost, near Autun, the roots of a species of *Lepidodendron* (*L. estnostense*) have buried in their parenchymatous tissue the eggs of an insect or arthropod, which has been named *Arthroon Rochei*.

Further details cannot be given here, but this notice should not be concluded without calling attention to the geological and even economic value of the work. It goes far toward furnishing the solution of many of the

most difficult problems that the study of the origin of coal and other fossil combustibles presents. It should be carefully studied from that point of view.

Neither should the fact be left unstated that in these difficult and recondite researches M. Renault has advanced theories that are not accepted by all, but the criticism and, if need be, the disproof of which belongs to those who are engaged in the same line of investigation and are equipped for such a task.

LESTER F. WARD.

The Elements of Astronomy. By Sir ROBERT BALL. New York, The Macmillan Company. 1900. 183 pages, 23 figs., and 11 full-page plates. Price, 80 cents.

This little book contains a clearly written account of astronomical subjects, adapted to the needs of beginners. After a brief historical introduction and an explanation of the apparent diurnal motion of the celestial sphere, the Sun, as the heavenly body most important to us and most interesting to the novice, is rightly placed first. If any change were to be suggested here, it would be that this topic should receive fuller treatment and more complete illustration. The author's admirable *Story of the Sun*, which is both accurate and interesting, fits him to present this subject advantageously.

It is to be regretted that the eclipse photographs, which are supposed to show solar prominences and the corona, are so badly reproduced as to be almost worthless; and while the introduction of photographic illustrations directly from nature is very desirable, the public has a right to demand that such pictures in a work of more than ephemeral value shall have that degree of precision which modern art processes are able to give. In case the publishers have not at their command facilities for reproducing pictures with delicate details, a well-executed engraving, correctly interpreting such details, is to be preferred to a poor photograph. Good illustrations are given of the Full Moon, Saturn, Jupiter, the Dumbbell Nebula, and clusters in Hercules and in Perseus.

Since one of the objects of scientific study is to inculcate conceptions of precision, the indiscriminate grouping of stars of several orders of magnitude from Sirius (—1.5 mag.) to Capella (0 mag.) under the title 'first magnitude' stars (p. 7–8) is to be deprecated.

In an edition prepared for American readers it might be well, if a common name is to be used, to substitute The Dipper for The Plough in designating a part of Ursa Major which 'in this country' is familiarly known by the former title.

A similar remark applies to the statement on p. 57 that midsummer twilight in 'our' latitudes lasts all through the night, which lacks generality and is inappropriate in a science whose chief merit as a discipline for young readers is that it tends to broaden our conceptions by wiping out local distinctions.

The author's familiarity with mathematical processes gives him a firm grasp on everything of a geometrical nature, but also a beautiful simplicity and directness in his demonstrations, which does not always follow from individual comprehension. The chapter on the diurnal motion is simplified by the omission of some details which would have to be considered in a more extended treatise; but one cannot omit to note that quite apart from this, the method and language of the demonstration are uncommonly clear and convincing.

It is natural that we should expect the same clearness in those subjects which Sir Robert Ball has made peculiarly his own—such as precession and the tides—and the reader will not be disappointed here. The history of the Earth-Moon system and the chapter on gravitation will be found especially interesting.

It is permissible, even in an elementary treatise, that an author should develop somewhat those parts of the subject on which he is an authority and where he can speak better than any one else; and since a selection has to be made in a small work like this, it is just as well that the illustrations chosen should be those most familiar to the author; but there are other inequalities which cannot be commended.

A considerable space is devoted to an argument as to the exceedingly high surface-temperature of Jupiter, which is purely speculative,

and by no means as probable as the author maintains. The oceans of boiling water remind one of the cataclysmal hypotheses in vogue in earlier geological speculation, and raise the question whether here also there may not be a less sensational interpretation of facts.

The lunar temperature, on the other hand, in regard to which we have some knowledge derived from quantitative measurements, is not so much as mentioned in the book.

Barnard's fifth satellite of Jupiter is given a whole page, which, while commendable as an account of recent astronomical progress, seems to show a lack of perspective, since only an equal space is devoted to the other four moons with their wonderful harmony. Moreover, in spite of the prominence given to this excessively minute body, the moon, which continues to be called by an anachronism by the Roman numeral I, is alluded to as 'the innermost.'

The 'invisible rays' of the solar spectrum are treated as if they were synonymous with the ultra-violet rays. Over a page is given to this topic, but there is no mention anywhere of the much more extensive infra-red part of the spectrum which comprises rays of greater intensity and of more importance to the earth.

The statement on page 39 that 'we find each one of the multitude of lines in the artificial iron spectrum agreeing to the last degree of precision with the corresponding line in the solar spectrum,' is not in accordance with facts. Along with many wonderful coincidences, there are some notable differences which are of very great importance as furnishing a possible key to further solar mysteries.

The description of the solar corona and of sun-spots in Chapter II. is inadequate, and something more than a bare mention of the fact that there are different classes of stellar spectra is desirable; but the list of shortcomings is not long, and the book is to be commended for its attainment of an exceptional standard of excellence.

F. W. Very.

GENERAL.

Announcement has been made by a committee of American anthropologists, of which Mr. F. W. Hodge, managing editor of the *American Anthropologist*, is secretary, of the proposed publication of a series of more than thirty folk-tales recorded and translated by the late Frank Hamilton Cushing during his long and intimate association with the Zuñi Indian tribe of New Mexico. The price of the work will be $3.50. Information and subscription blanks can be supplied by the Secretary, whose address is Washington, D. C.

The late Professor A. W. Hughes, left in an advanced state of preparation a new volume on practical anatomy. Professor Keith, of the London Hospital College, has undertaken to complete Professor Hughes's work, which will be published by Churchill.

BOOKS RECEIVED.

Experimental Psychology. E. B. Titchener. New York and London, The Macmillan Company. 1901. Volume I. Part 2. Pp. xxxiii + 456. $2.50.

Human Placentation. J. Clarence Webster. Chicago, W. T. Keen & Co. 1901. Pp. 126 and 30 plates.

Studien über die Narkose. E. Overton. Jena, Fischer. 1901. Pp. x + 195. $4.50.

Morphology of Spermatophytes. John M. Coulter and Charles J. Chamberlain. New York, D. Appleton and Company. 1901. Pp. x + 188.

Les problèmes de la vie. Ermanno Giglio-Tos. Turin, Chez l'Auteur. 1900. First Part. Pp. viii + 286. 10 fr.

Clays of New York, their Properties and Uses. Heinrich Ries. Albany, University of the State of New York. 1900. Pp. 593–944.

The Manual of Laboratory Physics. H. M. Torry, and F. H. Pitcher. New York, John Wiley and Sons. London, Chapman and Hall, 1901. Pp ix + 288.

A Select Bibliography of Chemistry. 1492–1897. Section VIII. *Academic Dissertations.* H. Carrington Bolton. Washington, D. C., Smithsonian Institution. 1901. Pp. iv + 534.

SCIENTIFIC JOURNALS AND ARTICLES.

The Journal of the Boston Society of Medical Sciences for December 18, 1900, delayed on account of the plates, has recently been issued. It forms a volume of 180 pages and 16 plates after photomicrographs, devoted to 'A Study of the Bacteriology and Pathology of Diph-

theria,' by W. T. Councilman, F. B. Mallory and R. M. Pearce. The material was derived from 220 fatal cases of diphtheria, and the various regions of the body are treated in detail. An extensive bibliography of recent literature on the subject is appended, the whole forming a most important contribution to our knowledge of diphtheria.

IN *The American Naturalist* for March, W. M. Wheeler and W. H. Long describe 'The Males of some Texan Ecitons' and incidentally tell much of the habits of these ants and of the raids made by them on other species. W. H. Dall discusses 'The Morphology of the Hinge Teeth of Bivalves,' calling attention to the work of Bernard and Steinmann and giving preference to the formula devised by the latter for indicating the arrangement of the teeth and sockets. Harris H. Wilder describes 'The Pharyngo-Œsophageal Lung of Desmognathus,' showing that this species, and inferentially other lungless salamanders, breathes mainly by means of a definitely localized portion of the anterior part of the alimentary canal. J. Arthur Harris presents some 'Notes on the Habits of *Cambarus Immunis* Hagen,' showing that this species, like others of the genus, burrows, and implying that by this means the animals are preserved through the dry months of summer. Albert M. Reese tells of the 'Artificial Incubation of Alligator Eggs' by keeping the eggs in damp *humus* in an incubator at a temperature of 37° C. 'The Colors of Northern Apetalous Flowers' are considered by John H. Lowell, giving a table showing that the great majority are white or dull-colored, and concluding that they are of primitive character and not degraded entomophilous forms. 'The Prehistoric Workshops at Mt. Kinco, Maine,' are treated by C. C. Willoughby, who states that it is evident the products were mainly intended for transportation and to be finished at a distance.

IN the *Plant World* for February William Palmer tells of 'Deforested Cuba' and the manner in which the trees have been destroyed and the soil injured by the continued burning over of the land. Pauline Kaufman describes the 'Orchids in Central Park,' E. M. Williams 'The Masked Tricholoma' and Stewart H. Burnham 'A February Outing in California,' while 'The Discovery of a Plumose Variety of the Ebony Spleenwort' is noted by Francis B. Horton. In the Supplement, 'The Families of Flowering Plants,' Charles Louis Pollard treats of various families of the order Ranales.

THE February number of the *American Geologist* contains an article by S. P. Jones on 'The Geology of the Tallulah Gorge.' The Tallulah River is a tributary of the Chattooga and finally reaches the Savannah in South Carolina. The Grand Chasm of which the paper treats is situated in the crystalline area of Georgia and surrounded by granites, gneisses and schists, supposed to be pre-Cambrian. The principal constituent of the rock is quartz, but small quantities of feldspar and mica are present. The falls are found to have been produced entirely by the river and atmospheric agencies, and it is further found that both falls and gorge are of recent age. It has been shown by certain geologists, with whom the author concurs, that this stream is an example of piracy, having been captured by the Tugaloo from the Chattahoocha river and diverted into the Savannah. In 'Paleontological Speculations,' Mr. L. P. Gratacap gives a few notions derived from an extensive study of collections among which are mentioned those of the American Museum of Natural History. These are studied for the purpose of determining the variations whose accumulated force ushers in new forms in the life series and by whose influence on the organism as a whole a kinetic impulse is established in a new direction. The deductions of Dr. Succo, Professor H. S. Williams, Professor Alpheus Hyatt and others, concerning change of environment of air, water and deep sea, are discussed. The fauna of the different ages and their philogeny, and their development through following ages, are also discussed in an interesting manner. 'The Plan of the Earth and Its Causes,' by J. W. Gregory, follows, and is an interesting discussion of the prevalent theories of the earth's formation, and its growth to its present relations of land, water and air. The discussion is to be continued. Then follows the usual 'Recent Geological Literature,' 'Cata-

logue of Geological Literature' and 'Personal and Scientific News.'

Three new ornithological journals have appeared this year. *American Ornithology*, edited by Mr. C. A. Reed, at Worcester, Mass.; *The Petrel*, edited by Mr. J. W. Martin, at Palestine, Ore., and *The Bittern*, edited by Mr. G. M. Hathorn, at Cedar Rapids, Ia. On the other hand *The Western Ornithologist* has suspended publication.

SOCIETIES AND ACADEMIES.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of Science of St. Louis, of March 4, 1901, the following subjects were presented:

The Corresponding Secretary read a communication from Dr. Amos Sawyer, entitled 'Ethnographic life lines left by a prehistoric race,' the paper being illustrated by sketches, fragmentary human remains and stones, etc., derived from a prehistoric grave examined some ten miles southwest of Hillsboro, Illinois, on the west side of Shoal Creek. In one instance it was stated that a grave consisting of six slabs of limestone contained six skeletons, their thighs flexed upon the abdomen, the legs upon the thighs, their arms placed by their sides, and their heads at either end of the enclosing box and facing east and west. From the limited capacity of the slab-enclosed graves, the writer inferred that the remains had been placed in them after skeletonization, as there was not sufficient room for the number of bodies found unless the muscles had been removed, and it was argued from this that the remains were those of prominent men in the nation.

The Corresponding Secretary read a further communication from Dr. Sawyer, referring to a piece of wood found at a depth of 400 feet below the surface in sinking a shaft for a coal mine. The specimen was said to have occurred in a ten-foot layer of loam filled with the débris of a forest, and the specimen submitted, like others, had been flattened by pressure.

In the discussion which followed the reading of these communications, Mr. Colton Russell said that west of St. Louis, in a number of so-called Indian graves which he had examined, the encasing with rough limestone slabs, mentioned by Dr. Sawyer, had been observed; and Dr. Trelease called attention to the fact that the specimen of wood exhibited, which did not seem to be petrified, belonged to post-glacial times and was perhaps comparable with certain pieces of wood, supposed to be cedar, but not yet carefully studied, which Mr. Hermann, the Sewer Commissioner of St. Louis, had found in company with bones of the early bison in the glacial detritus through which a storm sewer is being excavated at Tower Grove, St. Louis.

A paper by Dr. T. Kodis, 'On the action of the constant current upon animal tissue,' was read by title.

Professor F. E. Nipher stated that he wished to take this occasion to correct some misapprehensions concerning the development of photographic positives. He stated that the effect of development in the light was to make the normal exposure for positives shorter than when they are developed in the dark-room. When for a given illumination of the developing room the exposure has been properly made, the ordinary developer used for negatives may also be used for positives without any restrainer. The restrainer is only needed when the plate to be developed as a positive has been under-exposed, or the plate to be developed as a negative has been over-exposed. In both cases it is an approach to the zero condition which calls for the restrainer.

Professor Nipher stated that Mr. Cockayne, of the Heliotype Company, of Boston, had suggested to him the use of potassium ferro-cyanide in place of potassium bromide in developing positives, and he had found it to give great brilliancy to the pictures. A Cramer 'Crown' plate exposed in a printing-frame for a couple of minutes at a south window, just out of the direct rays of the sun, under a thin negative or positive, may be developed at the same place. A few drops of a ten-per-cent. solution of the ferro-cyanide may be added, and even as much as one part in twelve of developer has yielded excellent results. The bath has in some cases been wholly made up of the ferro-cyanide solution, the other chemicals being added in dry form. The action of the ferro-cyanide is quite different from that of

bromide in equal strength, although it may be largely a matter of degree.

The bath should not be quite so strongly alkaline as for negatives, in order to get the best results. The best results when pictures are developed in daylight are as fine as can be obtained in the dark room, in the ordinary developing of negatives. Various developers have been tried, but none of them have yielded as good results as hydrochinon.

Mr. G. Pauls laid before the Academy a branch of a small hackberry (*Celtis*) which had become completely covered with the small nodular galls frequently borne in smaller quantities by the hackberry, and called attention to the fact that in this particular case the natural enemies of the gall-forming creatures seemed to have been absent, allowing of their unusual multiplication.

One person was elected to active membership.

WILLIAM TRELEASE,
Recording Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

THE 112th meeting was held March 13, 1901, at the Cosmos Club. The following formal communications were presented:

'The Soil Survey of Cecil County, Maryland,' by Mr. C. W. Dorsey. This example of recent soil-mapping, by the Department of Agriculture, was illustrated by a colored map showing the areal distribution of ten classes of soil.

'Discussion of Geologic Units—Formation, Stage and Age,' by Messrs. Bailey Willis, H. S. Williams and others.

Mr. Willis, in introducing the discussion, briefly reviewed past attempts to consistently divide assemblages of stratigraphic rocks into units. He pointed out that a clear distinction exists between division on lithological grounds, and division on paleontological grounds, and that this distinction should not be lost sight of. He believed that the cartographic unit, the formation, should be defined purely on the basis of lithological character. In regard to the terms used for the units of the lithological, faunal and chronological scales in geology, it is highly important that there should be unanimity in usage. Shall we attempt to reconcile and fix the usage of such English substantives as series, formation, system, stage, period, etc., or shall we adopt entirely new terms from some foreign, preferably dead, language, and so avoid tying up well known English words to definite restricted meanings? Several terms from the Sanscrit were given in illustration of this suggestion. Professor H. S. Williams called attention to the fact that a formation, as defined on purely lithological grounds, lacks true unity. Two scales must be used to scientifically describe the formations and faunas which the geologist studies—a structure scale and a time scale. The latter must express definite time values. Such values are presented by (1) the persistence of equilibrium of a particular fauna, (2) the persistence of a particular species, (3) the persistence of a genus, etc. Major J. W. Powell gave his experiences in devising a scientific nomenclature in psychology. He at first endeavored to redefine old words. Readers forgot his definitions and unconsciously used their own in reading his work. He strongly favored the adoption of new terms devoid of all confusing connotations. Mr. Whitman Cross illustrated the difficulties arising when a formation, once defined, is found to thicken and expand into several members in another portion of the field. He was emphatically of the opinion that the evidence of fossils should be freely used in addition to lithological distinctions, whenever such a course will lead to a fuller expression of the structural and historical facts in the geology of a given region.

F. L. RANSOME,
DAVID WHITE,
Secretaries.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 337th regular meeting was held on Saturday evening, March 23d.

Sylvester D. Judd presented a paper on 'Bird Food Problems,' stating that in studying the food of birds as indicated by their stomach contents, one was confronted with the problem of identifying the articles eaten from very small particles. He showed, illustrating his remarks with lantern slides, how the presence of grasshoppers, cut worms, the larvæ of may beetles, earthworms and various plants might be recognized under the microscope from minute

but characteristic portions of these animals or, in the case of the plants, by portions of the seeds or even the form of the starch grains.

F. A. Lucas spoke of 'Some Restorations of Dinosaurs' saying that while a short time ago the Dinosaurs were very imperfectly known, now, through the exploration of our western territory and the systematic methods employed in collecting, we had a very thorough knowledge of these animals and are even able to present restorations of their external appearance. The American Museum of Natural History, of New York, he said, led in this work, and the speaker explained the methods of collecting, showing views of some of the famous quarries and of the specimens as they appeared when prepared and mounted. The matter of restoration was discussed, and the deductions made from the skeletons described and various restorations shown made by Mr. Knight under the direction of Professor Osborn. F. A. Lucas.

WASHINGTON PHILOSOPHICAL SOCIETY.

The 532d meeting was held March 16, 1901. The first paper was by Professor Updegraff, of the Naval Observatory, on the 'Errors due to Imperfections on the Pivots of a Theodolite.' After a reference to the well-known theory of elliptical pivots in a V-bearing whose sides are at right angles, the speaker considered the case of an elliptical pivot resting on two cylindrical lugs or ridges; the result of the investigations is that the center of the pivot when rotated does not change its elevation, but has a small movement in azimuth. In the long discussion that followed, Mr. E. G. Fischer, mechanician of the Coast and Geodetic Survey, pointed out that in actual practice the unequal wear of different parts of a pivot, due to unavoidable inequalities in the steel and to use of only a small arc, introduced much greater errors than any due to the original imperfections of manufacture.

Mr. Hussey then gave (by invitation) 'An Informal Account of Recent Work at the Lick Observatory,' showing superb lantern slides of stellar spectra and nebula. The interesting facts which he presented have been made accessible to the public in other ways and need not be repeated here. C. K. Wead,

Secretary.

TORREY BOTANICAL CLUB.

The meeting of January 30, 1901, was held at the Botanical Academy, Bronx Park, New York City.

A paper was presented by E. S. Burgess on the history of *Aster Claytoni*, soon to appear in print. A series of specimens was exhibited showing type and variations, and a range from the Hudson River to Virginia. The first specimen known was collected in the mountains of Virginia by John Clayton, apparently in or before 1754, during his botanical expedition along the James or that to the sources of the Rappahannock. It is No. 767 of the Gronovian herbarium preserved by the British Museum. Comparisons, kindly made by Mr. Edmund G. Baker, of the British Museum, show its identity with plants observed first on Manhattan Island at Inwood by E. S. Burgess in 1896, and kept under observation since for study of development. The description of No. 767, written by Clayton and Gronovius, and published in the 'Flora Virginica,' Part III, in 1762, without a specific name, long remained without reference to any of our known native species, Forster's reference in 1771 to *Aster macrophyllus* proving untenable. In reestablishing the species in the 'Illustrated Flora,' in 1898, under the name *Aster Claytoni*, it was intended to pay this tardy tribute to the memory of its discoverer, John Clayton, rightly styled by Collinson as at that period, 1764, 'the greatest botanist of America.' The species seems particularly frequent in the lower Hudson region, where it had, however, been hitherto confused with its smoother and more forking ally, *Aster divaricatus*.

At the meeting of February 13, 1901, at the College of Pharmacy, in New York City, Dr. J. K. Small presented a paper entitled, 'Notes on Some Species of *Rudbeckia*,' exhibiting a series of specimens of *Rudbeckia*, illustrating groups typified by *R. hirta*, *R. triloba*, *R. laciniata*, etc. Numerous critical characters depending on style-tips, form, serration or lobation of leaves, etc., were discussed. About 25 species occur east of the Rockies, 3 native to our own vicinity. All evidence shows *Rudbeckia hirta* to be an introduced plant in the northeastern states, perhaps from Maryland northward. Dr. Underwood remarked that *R. hirta* seemed to be first

introduced into Central New York about 1864. Dr. Rusby referred to its rarity within his memory in the vicinity of New York City, and to the recently discovered medical value of the related genus *Echinacea*. Dr. Britton called attention to the supposed variants of *R. hirta* with parti-colored rays, as suggested by plants from near Philadelphia and from Staten Island.

Dr. Britton presented the subject of the relationship of our woodland species of *Circæa*, *C. Lutetiana* being the representative near New York City, and extending widely around the world. The characteristic bristles of the fruit fail to appear in a remarkable specimen from Ohio which was exhibited. *C. intermedia* of Central Europe was also discussed in its relations to the foregoing.

The third paper, also by Dr. Britton, was upon *Antennaria*. Dr. Britton exhibited a series of specimens of *Antennaria neodioica* Greene, a species which seems to be easily distinguished from the others of eastern North America by its spatulate basal leaves, distinctly mucronate, tapering rather abruptly from well above the middle into a long narrow base, which, however, can scarcely be called a petiole. He showed specimens of the plant collected in company with Professor Greene at Bushkill, Penn., on the Club's Field Meeting, May 30, 1897, at which time Professor Greene first insisted on its specific difference from *A. plantaginifolia* with which it grew. The series included authentic specimens of *Antennaria rupicola* Fernald, which differs only from the typical specimens in the yellowish involucre, and slightly less abruptly tapering leaves, collected by Mr. Fernald at Island Falls, Aroostook Co., Maine, a character which can hardly be maintained for specific distinctness; also specimens of *A. neodioica attenuata* Fernald, which differs from the type in its slightly more acuminate inner involucral bracts and relatively broader leaves, and is identical with *A. alsinoides* Greene, original specimens of which were also included in the exhibit; also of *A. neodioica grandis* Fernald, which differs from the latter only in size. He concluded that the series represented only one species, *A. neodioica*.

Dr. Rusby referred to the similar variability of Andean species of *Gnaphalium* as seen by himself and other botanists in Bolivia.

Dr. Howe discussed the relationship of *Riccia Beyrichiana*, the hepatic which he had considered to be probably identical with one discovered by Mr. R. Harper near Athens, Georgia, last summer. The loan of the type-specimen from Vienna now shows that the two are wholly distinct, Mr. Harper's plant representing a new species, soon to be described in the *Bulletin*. *Ricca Beyrichiana* seems, therefore, to be still known only from the original collection of 1833.

EDWARD S. BURGESS,
Secretary.

SCIENCE CLUB OF NORTHWESTERN UNIVERSITY.

THE last meeting of the Science Club of Northwestern University was held on March 1st. Professor A. R. Cook addressed the Club on 'Minerals of the Chicago Area.' The region, though containing no stores of precious metals, or gems, and though not mentioned in lists of mineral localities, has minerals enough; first, to represent five out of the eight classes into which the mineral kingdom may be divided; second, to illustrate the chemical, crystallographic, optical and other physical properties of minerals, and third, to show the chief methods of investigation.

Thus far forty-eight minerals have been found and studied. One fourth of them occur in the underlying Niagara limestone. They are of such character as the geological history of the region would lead us to expect.

Those occurring in the Niagara are most important since they most properly represent this region. They are sulfur, galena, sphalerite, pyrite, marcasite, quartz, limonite, calcite, dolomite, siderite, melanterite, petroleum, gas, asphalt.

The sulfur occurs in crumbling rounded masses in the center of the decomposing marcasite. Galena and sphalerite are in crystalline masses with occasional crystal planes developed, showing characteristic cleavage, and contained both in limestome and in quartz.

Pyrite is most common when the containing limestone most nearly approaches the purity of calcite. The surprising condition is the great abundance of the orthorhombic form of the iron sulfid. Pyrite is rare but marcasite occurs in

extensive beds where it has been sorted out by hydraulic action as in the Des Plaines valley or on the lake shore. A bed several feet wide extended along the water's edge for two hundred feet where the lake was encroaching upon the shore. The marcasite soon disappears upon exposure; it is of such occurrence in the region as to contribute to our knowledge of the species.

Quartz occurs in abundance in both phanerocrystalline and cryptocrystalline varieties. Good scalenohedrons of calcite are found at Stony Island imbedded in asphalt.

The asphalt and maltha which are usually disseminated through the Niagara limestone of the region occur quite pure in cavities formed by the dissolution of fossil cœlenterates, echinoderms and mollusks in the strata at Stony Island.

The average of four analyses showed 15% mineral matter, 82% organic matter soluble in CS_2, and 2% of organic non-bituminous matter.

The asphalt contains 25% petrolene and 75% asphaltine.

Horace M. Snyder,
Secretary.

DISCUSSION AND CORRESPONDENCE.

The Application of Precedence of Place in Nomenclature.

It has occasionally happened in descriptive botany and zoology that two or more different names have been published by an author for the same species in the same work, even on the same printed page; in most such cases this has occurred by reason of the author regarding differing forms of the same organism as specifically different, which by subsequent observation has proved to be erroneous. The principle of now using the first in position of these two or more names as the true one, has obtained wide recognition, and is a simple and convenient method to reach this result.

There are also a few cases where the same thing has occurred with generic names, that is to say, by different generic names being published in the same work for groups of species which subsequent study has indicated to be more satisfactorily regarded as within the natural limitations of a single genus, and here precedence of place has also been invoked to determine which appellation the combined genera should bear. Here, as in the case of species, it is only a question of determining which of one or more names for the same things is the one to be employed.

The principle has been referred to as 'priority of place,' and perhaps not improperly, but it is quite a different matter from priority in time of publication, though in its application operating in the same manner to determine which of two or more rival names is to be used. It finds its most explicit presentation in the rules for nomenclature adopted by the botanists of the American Association for the Advancement of Science, at the Madison meeting in 1893, where it is thus stated:

In determining the name of a genus or species to which two or more names have been given by an author in the same volume or on the same page of a volume, precedence shall decide.

More recently it has been proposed by some botanists, as had previously been done by some zoologists, to fix the type species of every genus originally published with more than one species, by selecting for this the species which stands first on the page at the place of publication, and it has been contended that this is a logical outcome of the principle, thus giving it a widely different application from that contemplated in the rule cited above, by making it apply not to the determination of equivalent names for the same thing but to non-equivalent names for different things, a wholly different proposition. Inasmuch as a great many genera have at their first publication been made to include more than one species, and in a large number of instances some of these, often the first in position, have been used by subsequent authors as the types of additional genera, this latter-day proposition affects an enormously greater number of cases than those which fall properly under the operation of the rule.

It is, therefore, clear that there is nothing logical in the proposed extension of the principle. This would, of course, operate as an artificial short-cut in determining generic types, except in the cases where the first species named is not definitely understood, but in many instances it would lose the historic type

altogether, and in others it would render useless for nomenclatural purposes much original investigation through which genera have been definitely established. Unless rigidly restricted in such a way as to avoid these defects it would be impracticable and undesirable.

N. L. BRITTON.

CLAYTON'S ECLIPSE CYCLONE AND THE DIURNAL CYCLONES.

MR. H. H. CLAYTON, of the Blue Hill Meteorological Observatory, Mass., has published an account of his discussion of certain meteorological observations made during the eclipse of May 28, 1900, in the *Proceedings of the American Academy of Arts and Sciences*, Vol. XXXVI., No. 16, January, 1901; and the full report in Vol. XLIII., Part 1, of the *Ann. Har. Coll. Obs'y*, 1901. Mr. R. DeC. Ward reviews these papers in SCIENCE of March 1, 1901, and says, "Clayton has gone far ahead of all previous investigations of the phenomena of eclipse meteorology. The low temperature, the circulation of winds and the form of the pressure curve all proclaim the development by the eclipse of a *cold-air* cyclone, as described by Ferrel; * * * The fall of temperature due to the occurrence of night must also produce, or tend to produce, a cold-air cyclone. Since the heat of day produces, or tends to produce, a warm-air cyclone; * * * These causes must, in the opinion of the author, produce entirely, or in part, the well-known double diurnal period in air pressure; * * * His explanation of the diurnal variation of the barometer seems to have in it many evidences of being the best yet offered to account for this puzzling phenomenon."

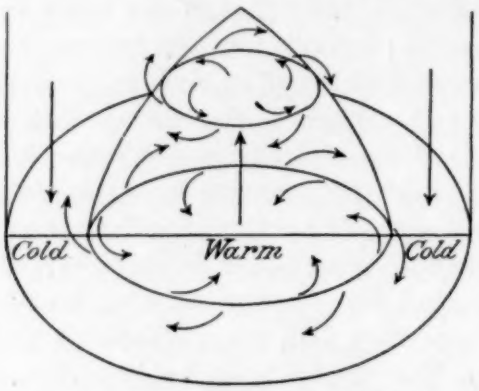
I suspect that Mr. Clayton and Mr. Ward have an incorrect conception of Ferrel's cold-center cyclone, or else they could hardly have written about it the remarks contained in these papers. The subject is rather complex, but I hope, very briefly, to indicate the leading discrepancies for the benefit of others who think that the problem of the diurnal variation of the barometer can be solved along these lines.

1. *Some Minor Errors.*—Clayton's Formula, page 8, $\tan\theta = \frac{\Sigma(\sin o)\,v}{\Sigma(\cos o)\,v}$ should be written $\tan\theta = \frac{\Sigma v.\sin o}{\Sigma v.\cos o}$, where o is the azimuth of the observed wind, and θ that of the mean or prevailing wind; but this function between θ and o is incomplete and it often gives an incorrect result. In the diagram the wrong diagonal is drawn, and this introduces confusion into the exposition of the formulæ for determining C, used in $\theta^1 = \theta \pm 180 \pm C$, where θ^1 is the azimuth of the eclipse wind which is required. As the eclipse wind for Washington, Ga., Wadesboro, N. C., and Blue Hill were computed by these formulæ, the results must be imperfect. The observations were themselves not very satisfactory, as is inferred from the account of them.

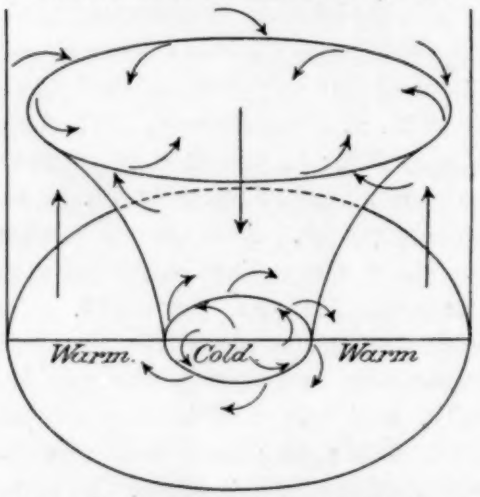
2. *The Cold-Center Cyclone.*—Ferrel's account of the cold-center cyclone is found in the Report of the U. S. Coast Survey, 1877, Appendix No. 20, page 187; in the Report of the Chief Signal Officer, 1885, Appendix 71, page 257; and in other places. Also there are some general remarks on the subject in the International Cloud Report, 1898–99, page 615. The accompanying diagrams show the circulation in the warm-center and cold-center cyclones, respectively, and the distributions of pressure characteristic of them; these must serve for further explanations in this place. In order that there may be no doubt about Ferrel's idea of the cold-center cyclone, I quote from the Report of the Chief Signal Officer, page 257, "The gyrations at the earth's surface must be in the same direction as in the case of ordinary cyclones; * * * The interchanging motion is from the center below and toward it above." Report of Coast Survey, page 188, "The maximum barometric pressure is where the gyrations are reversed; * * * The pressure is a minimum at the center and a maximum at the edge" of the cold-center cyclone, at all altitudes, meaning by edge the locus where the gyrations reverse direction.

Ferrel illustrates the cold-center cyclone in these two reports, also in his popular treatise on the winds, pages 246–247, 337–342, by comparing it with the general circulation over a hemisphere of the earth, where the poles are cold and the tropics warm, and states that the circulation is the same in each. That is, the air descends at the pole, flows south and *east*

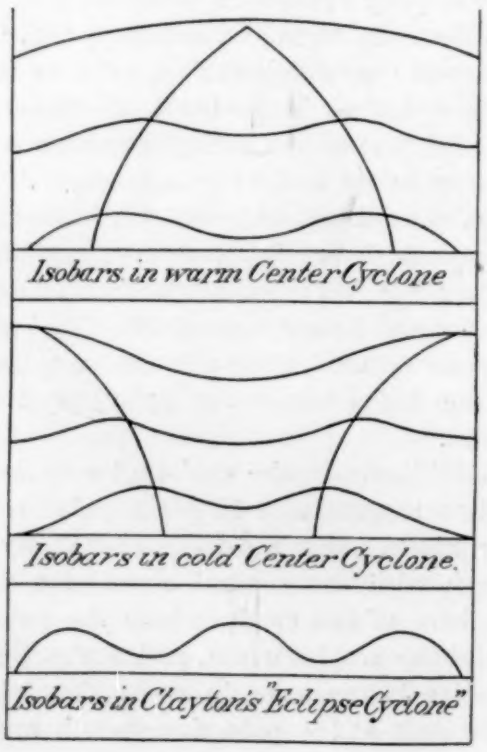
(not west) to latitude 30°, thence south and *west* (not east) to the equator, in which region it ascends, etc. Thus, page 337, "This vertical circulation, as in the case of the ordinary cyclone, gives rise to a cyclonic motion in the interior (that is, to the place where the gyration reverses from $+v$ to $-v$) and an anti-cyclonic in the exterior part." Cyclonic rotation is against the hands of a watch, looking down upon it, and anticyclonic is with the hands, so that in warm and in cold-center cyclones the rotation is cyclonic near the center, and anticyclonic beyond a certain circle of reversal. In the warm-center cyclone the motion is ascending and inward near the surface in the interior and descending in the exterior; in the cold-center cyclone these motions are reversed, but the *direction of rotation about the pole is not changed.* Ferrel's formulæ, diagrams, and discussions agree in this throughout his works; indeed, there could be no other interpretation of them on mechanical principles. He says, C. S. O., page 203, "Such areas of high barometer (referring to the high pressure area produced by the overlapping of two adjacent cyclones) are usually called anticyclones, and the air does in some manner move around them in a direction contrary to that of a cyclone, but this does not arise from a central area of greater cold, for it has been shown that such a condition *would give rise to a cyclone and not to an anticyclone*, and that the latter would be entirely at variance with fundamental and well established principles of mechanics."



Circulation in warm Center Cyclone



Circulation in cold Center Cyclone



When the temperature gradients are very steep and there is much friction on the surface, a small secondary maximum pressure may develop in the center of the cold-center cyclone. In the case of the eclipse the temperature gradients were feeble, and the wind velocity v small, upon which the friction-force $= k.v$ depends, so that it could not happen under the circumstances of the eclipse phenomenon.

Now by comparing Clayton's diagram, Fig. 5, Plate II., for the wind direction, we find a *true anticyclonic* configuration at the center, and this rotates in the opposite direction to that required in the cold-center cyclone; if wind stream lines were to be drawn from the center outward at *right angles* to those contained in the Clayton diagram, we should then obtain a cold-center cyclonic circulation,

but this is just the opposite of the result of the eclipse observations. Furthermore, Plate III., 'Pressure in Eclipses,' shows us the variations in pressure as observed, and these are reproduced in the lowest section of the adjacent diagram. It is seen that the pressure in the eclipse is *reversed throughout its length to that required in the cold-center cyclone.* The Weather Bureau observations at sixty-five stations confirm the Clayton distribution of pressure, but the conclusion is also unavoidable that we are not dealing with a cold-center cyclonic circulation. My further remarks on this subject will be found in the forthcoming report by the Weather Bureau.

3. *The Semidiurnal Cyclones.*—Even if the analogue between the eclipse circulation and that assumed to exist in the nocturnal circulation were not hopelessly in error, there are yet other difficulties to be considered, even supposing the cooled hemisphere of the atmosphere were to produce something like a cold-center cyclone and the heated hemisphere a warm-center cyclone. (*a*) The vertical circulation in the cold-center and in the warm-center cyclones are in *opposite directions* to one another at the belt of highest pressure, so that they would tend to destroy each other, rather than build up any high pressure belt such as the diurnal pressures require. (*b*) If there is a cyclonic circulation of any kind, the conditions demand that the pressure be distributed quite symmetrically on all sides of the center in order to maintain a true gyratory motion; but in the diurnal barometric pressure there are found to be simply two peculiar waves extending from pole to pole, which do not in the least form such a symmetrically distributed pressure about a center. Compare Int'l Cloud Report, Chart 44. (*c*) According to Clayton, Plate IV., the high pressures at the surface shift about 90° in the higher strata. But so far as I know, the only data bearing upon this point are contained in the Blue Hill hourly cloud observations, and these show that the *same diurnal circulation* exists in the atmosphere from the surface to the cirrus level. However, this may be a doubtful point and I will not press its accuracy. Compare Int'l Cloud Report, Chart 45.

I have generally found myself in accord with Mr. Clayton's published results, and I am sorry to be obliged to dissent from his interpretation of the eclipse observations in this case. The variations of pressure in the eclipse are not larger than 0.01 inch of mercury, and the velocity of the eclipse wind is only 2 or 3 miles; but it would seem hardly credible in the face of these facts that this small atmospheric disturbance should set up any true cyclonic circulation over an area 5,000 miles in extent, as is claimed in the report under consideration.

FRANK H. BIGELOW.

WASHINGTON, D. C., March 20, 1901.

THE REVERSAL OF THE PHOTOGRAPHIC IMAGE BY CONTINUED ACTION OF LIGHT.

THE remarkable results described by Professor Francis E. Nipher, in developing photographic plates in daylight, bring to mind some of the earlier experiments upon the reversal of the photographic image. It has long been known that under particular conditions of over-exposure in the camera a positive, instead of a negative, is produced by ordinary development. This result has been repeatedly observed by amateurs, much to their astonishment and mystification.

The present writer has several times attempted to bring about the effect by prolonged exposure in the camera, but without success. The necessary conditions not being known, the result is accidental and uncertain. The idea of giving a supplementary exposure of the plate in broad daylight did not suggest itself; indeed, it is not one that would spontaneously commend itself to a photographer. All his previous training and experience is opposed to it on general principles.

Nevertheless, it is not entirely new. Herschell, in the year 1839 or 1840, did very much the same thing. He observed reversals of photographic action, and so did Draper on strips of sensitized paper with which he was studying the chemical action of the sun's light in Virginia, and photographing the spectrum in ephemeral colors. This subject was referred to quite recently in an article by the present writer, entitled, 'Tithonic Rays and Early

Photographs in Color,' published in the *International Annual of Anthony's Photographic Bulletin*, XIII. (1901), 107. At that time and also many years later, the effects observed were attributed to an antagonistic action between light radiations from different parts of the solar spectrum.

Many years ago, when collodion wet plates were mostly in vogue, there was considerable discussion among photographers of the effect of exposing sensitized plates to diffused daylight, either before, during or after the usual exposure in the camera. Some claimed that such a supplementary exposure made the plates more sensitive, so that the camera time was materially shortened. The admission of a little diffused light through a hole in the camera was claimed to be advantageous in the same way. Others questioned the utility of the practice and the question was finally dropped and forgotten.

There may have been a basis of truth in the contention of those who advocated the supplementary exposure, but it was not satisfactorily established at the time. There is less reason for skepticism now than there was in those days. Although not exactly in line with Professor Nipher's work, the subject bears a close relation to it.

More directly connected with the recent observations is the work of M. J. Jansen, at Meudon, in the year 1880, when he was engaged in studying the solar radiations. In his original communication to the French Academy, published in *Comptes Rendus* of that year, he used the following language descriptive of his work: "I have the honor to inform the Academy of the discovery of a fact to which I have been led by my studies in the analysis of the light of the sun and of its photographic images.

"This fact consists in this, that the photographic images may be reversed, and pass from negative to positive by the prolonged action of the light which has produced them."

Ordinarily the exposures for negatives were about one-thousandth of a second, or when bromide plates were used, one ten-thousandth. But when the exposures were prolonged to half a second or a full second—increased 10,000 or 20,000 times—he obtained a positive picture instead of a negative.

The investigations were continued and in a second communication to the Academy, also published in *Comptes Rendus* (Vol. XCI.), he made known some remarkable results.

By varying the times of exposure he found an intermediate condition of the plate at which neither a positive nor a negative could be developed. His conclusions may be briefly summarized here. With exposures of increasing duration he discovered six different successive conditions of the sensitive plate. These developed in order as follows:

1. A negative. The ordinary negative.
2. A first neutral condition which blackened uniformly in the developer.
3. A positive.
4. A second neutral condition, opposed to the first, which became uniformly lighter in the developer.
5. A second negative, similar to the first but differing by the enormous amount of light required to produce it.
6. A third neutral condition, in which the negative of the second order had disappeared and was replaced by a sombre, uniform tint.

These facts were established with different kinds of plates—tannin plates, gelatin-bromide and others.

It is scarcely necessary to indicate the bearing of these observations on the results of Professor Nipher's experiments. Does not the fourth condition suggest that if a plate in that stage were developed in a lighted room it would show a negative picture?

About the time of these observations of Jansen, considerable attention was being directed to the subject of reversals of the photographic image; but most of the literature deals with theories in explanation of the facts. Although the discussion was sufficiently instructive and interesting, it does not seem to me that we are sufficiently acquainted with the chemical effects of light in photography to warrant much chemical theorizing in this particular field.

Romyn Hitchcock.

New York, March 18, 1901.

SHORTER ARTICLES.

A NEW OCCURRENCE OF CASSITERITE IN ALASKA.*

DURING the past season while making a hasty reconnaissance of the York gold field of Alaska, my attention was called to some auriferous gravels which carry a large percentage of stream tin. This stream tin is found in considerable quantities on Buhner Creek, which enters the Anakovik River from the west about three miles from Behring Sea. The occurrence is perhaps best located by stating that it lies some ten miles east of Cape Prince of Wales and hence very near the northwestern extremity of the continent. On Buhner Creek some two to three feet of gravel overlie the bed rock which consists of arenaceous schists which are often graphitic, together with some graphitic slates. The bed rock is much jointed, the schists being broken up into pencil-shaped fragments. They strike nearly at right angles to the course of the stream and offer natural riffles for the concentration of heavier material. A hasty reconnaissance of the drainage basin of this stream, which includes not more than a square mile of area, showed the same series of rocks throughout its extent. At a few localities some deeply weathered dark green intrusives were found, which, on examination by the microscope, were found to consist almost entirely of secondary minerals. In some cases, however, a little plagioclase was still unaltered and a suggestion of ophitic structure remained, so that these are probably of a diabase character. The slates and schists are everywhere penetrated by small veins consisting usually of quartz with some calcite and frequently carrying pyrite and sometimes gold. These veins are very irregular, often widening out to form blebs and again contracting so as not to be easily traceable.

The stream tin is concentrated on the bed rock with other heavy minerals and was found by the miners in the sluice boxes. A sample of the concentrate in one of the sluice boxes was examined by Mr. Arthur J. Collier and yielded the following minerals: cassiterite, magnetite, ilmenite, limonite, pyrite, fluorite, garnets and gold. The determination of percentage by weight was as follows: ninety-five per cent. tin-stone, five per cent. magnetite; other minerals five per cent. The cassiterite occurs in grains and pebbles, from those microscopic in size to those half an inch in diameter; they have sub-rounded and rounded forms. In some cases there is a suggestion of pyramidal and prismatic crystal forms. The cassiterite varies from a light brown color to a lustrous black.

A second locality of this mineral was found on the Anakovik River half a mile below the mouth of Buhner Creek. Here the cassiterite is also found with the concentrates from the sluice boxes of miners. I observed one specimen from this locality which was some two inches in diameter.

During the hasty reconnaissance no acid intrusives nor pegmatite veins were found in the drainage basin. The nearest known granitic rocks are in the biotite granite mass which forms the promontory of the Cape Prince of Wales. It is hoped during the coming season that more detailed work in this region will throw further light on these interesting deposits.

ALFRED H BROOKS.

* Published by permission of the Director of the U. S. Geological Survey.

NOTES ON PARASITES — 56: ECHINOSTOMUM BURSICOLA LOOSS AND E. CLOACINUM BRAUN, FROM A NOMENCLATURAL STANDPOINT.

PROFESSOR MAX BRAUN * has recently proposed the name *Echinostomum cloacinum* as a substitute for *Distomum bursicola* Creplin, upon placing this species in the genus *Echinostoma*. Braun's reason for changing the specific name is that there is already an *Echinostomum bursicola* Looss, 1899, and he assumes that this invalidates the specific name *bursicola* Creplin, 1837.

In this decision, Braun has fallen into error. It is not *bursicola* 1899 which invalidates *bursicola* 1837, but the latter invalidates the former. Hence *E. cloacinum* Braun, 1901, must fall as a

* 1901.—Ueber einige Trematoden der Creplins'chen Helminthensammlung. Cent. f. Bakt. Paras. u. Infek., XXIX., 1 Abt., No. 6, Feb. 25, 258–260.

synonym of *Echinostoma bursicola* (Creplin, 1837) nec Looss, 1899.

In order to straighten out the synonymy immediately, I here propose the name *Echinostoma africanum*, nomen novum, as substitute for *E. bursicola* Looss, 1899, nec (Creplin, 1837) Stiles, 1901.

Ch. Wardell Stiles.
Bureau of Animal Industry.

AMATEURISM AND MENTAL INERTIA IN PUBLIC SERVICE.

In a striking presentation of the results of 'Official Obstruction of Electric Progress' in Great Britain, by Professor J. A. Fleming, in *The Nineteenth Century* for February, that distinguished writer and scientific authority describes the outcome of the existing system of public service in Great Britain in the departments of telegraphy and telephony and the relative retrogression of that nation in all departments of electrical engineering. "In reviewing the nationality of those who have thus helped to make the electric current the humble servant of mankind, it is impossible not to be struck with the fact that British names do not preponderate."

In pure scientific research, Great Britain has held her own; in detailed improvements and minor advances she has not been backward; but has made no fundamental invention or discovery, except, perhaps, those 'of Lord Kelvin in submarine telegraphy, of Mr. Swan in electric lighting and of Professor Hughes in telephony'; practically all first-rate novelties have originated in other countries, for a generation past. The reason is attributed largely to the fact that in 1870, just at the dawn of the period of electrical activity, the Government set itself up in business as an electrician and proceeded to create a gigantic Government monopoly in one large department of electrical invention which has exercised a most undoubted control over the supply and demand for invention in a wide area of electrical work. It invested £10,000,000 in telegraph purchases, made the business a monopoly, and thus smothered invention through that monopoly and an always characteristic governmental inertia, an inertia, misnamed conservatism, always to be observed where, as in such cases, the alertness in effecting improvement and in competition which characterizes private business for private profit is absent. This 'conservatism' is seen in all departments of the public service and is liable to produce serious retrogression in every national enterprise and in all countries. It was also illustrated, according to Professor Fleming, in the case of the telephone. No sooner was this extraordinary invention made practicable than the British Government, even without explicit authority of law, compelled its proprietors and promoters in that country to pay tribute to the Postal Department, and to-day, while the postal service and the telephone are conducted at a loss, the telephone is made to contribute, without substantial return to its proprietors, the amount of £130,000 to the profit side of the postal service ledger; while the official service of the telegraph, too largely amateur, brings in a loss of over £220,000. The National Telephone Co. has paid into the treasury of the postal service over a million of pounds, since its capitulation to that service, as a 'tax on a new industry barely twenty years old.' The higher tribunals have never confirmed this act of piracy, as it is considered by the members of the company.

As this writer states: "The whole behavior of the post-office towards private enterprise in telephony in the last twenty years has been marked by inconsistency, inaptitude and want of prevision." The business which it itself conducts is a source of enormous loss; that which it simply taxes and burdens pays a sufficient profit to bear this invidious taxation, to which other industries are not subjected. It is a fair presumption that, were the telephone managed directly by the Government, it would exhibit a lack of thrift and efficiency similar to that characterizing the postal and the telegraph business. Meanwhile, also, the postal service deliberately impedes the telephone management in its endeavors to secure rights of way, and compels it to charge the public a much higher tariff than would be fair and practicable were it not discriminated against in taxation, and thus its range is restricted as well as its value to those who are able to secure its service. In all ways the hope of reward which is the

great stimulus of the inventor and of the promoter of new improvements is repressed. The conclusion of the writer of the paper referred to is: "The most effective method of afflicting any department of applied science with creeping paralysis is to constitute it a government monopoly."

While the State electricians would probably declare that they are 'ever on the outlook for new things,' the record is shown to invalidate that claim, at least to the extent of showing that the new things have come vastly more certainly and promptly to the private management. Inventions have been extensively exploited by private means and private companies far in advance of any governmental action, and the inventor proverbially dreads the necessity of going with his plans to a governmental department in all countries and whatever his field of work. Even the inventor of the apparatus of war has his bitter experiences with the official, and the history of the work of Maxim and of Broadwell still earlier, among our own great inventors, may be added to the examples quoted by Fleming, of Morse, of Trowbridge, of Marconi and others. Government officials do not always cordially and sincerely strike hands with the inventor, even where competent to appreciate his work, and it is too often the fact that they prefer to hold him at arm's length until one of their own caste or a partner in invention can find ways of evading his claims and of reaping the harvest he has sown.

"The State officials guard a monopoly. It is in their power to take or reject improvements. They set the pace in one large department of electrical invention and it cannot be forced." As Mr. Edison said to Professor Fleming when the latter explained the nature of these governmental impediments of progress in electrical development: 'Why! They've throttled it!'

In electric traction the same difficulties are interposed, in appropriate ways, by the official brakesmen. Great Britain has to-day about 400 miles of track; the United States has 12,000 or more. In that country any local government may take away the property of any tramway within its limits, at the appraised value of its real property, after twenty years of service. This provision of law has crippled the enterprise. 'To tell an investor in tramway stocks that, after passing through a long non dividend-paying period, he has then the prospect of having his property taken from him at a breaking-up price, and perhaps half his property confiscated,' is to warn him not to invest. Thus the business languishes and the builder of even the comparatively promising railways about London must come to the United States for all his material and machinery.

Scientific education is looked upon as one element of the needed radical reform. But "What is required is not abundant mediocrity, but a fully sufficient opportunity of training those who will be captains of industry. The persons who need technical education are the masters much more than the men."

Throughout the whole article, of which we have here presented so extended an abstract, the evidence is strong that the dangers of that amateurism and of that officialism which are now beginning to awaken intelligent men, and especially men of science and men of applied science in the United States, to serious apprehension relative to all public services involving scientific work or development, have secured a firm and dangerous hold in Great Britain and constitute undoubtedly one of the elements of that apparent relative retrogression in the industries which has of late attracted so much attention and awakened such earnest discussion in the scientific and technical journals, and even to some degree in the columns of the 'Thunderer' itself. The republication, by the Harpers,* of letters to *The Times* from a British engineer visiting the United States, furnishes and preserves an interesting and instructive commentary upon these facts.

R. H. THURSTON.

MUSEUM METHODS ABROAD.

THE appearance of the eleventh annual report of the Museums Association, of Great Britain, reminds one that it is as nearly as possible eleven years ago that the Association of American Naturalists decided that so far as museums were concerned nothing remained for

* 'American Engineering Competition.' New York and London, Harper and Brothers. 1901. 8vo. Pp. 139.

it to do. The present report consists of xxiv + 157 pages, a trifle larger than the average of the reports, and besides the matter pertaining solely to the workings of the Association, comprises the address of the president, Dr. Henry Woodward, twelve papers, general notes, museum reports and a list of museum publications. Dr. Woodward's address is practically a brief review of the relations of the British Museum to the public and what it has done in the way of the arrangement and display of specimens to interest and instruct visitors, particular attention naturally being given to the display of paleontological material. Dr. Woodward has come to the same conclusion as that expressed by the writer some years ago in SCIENCE, that the complete mixture of recent and fossil animals in the exhibition series is inadvisable and the best results are to be obtained by introducing a few carefully selected and typical examples of living animals into the series of fossils, and rounding out the display of recent animals by the introduction into the exhibition series of a few fossils. "This limited introduction of existing forms, aided by diagrams, drawings and separate parts, does not break up the arrangement of the collection (of fossils) as a whole, but vastly enhances its usefulness to the student."

The aims and arrangement of various museums are described in more or less detail in several papers, including the Hastings Museum, Worcester, by W. Edwards; the Horniman Museum, London, by Richard Quick, and the Norwich Castle Museum, by Henry Woodward.

W. M. Flinders Petrie discusses the question of a 'National Repository for Science and Art,' advocating the acquisition of about a square mile of land within an hour of London (the scheme naturally applies to all large collections) on which should be built a series of one-storied galleries lighted from above; these galleries to be 54 feet wide and about 400 feet apart. The object to be attained by this method is to provide ample room, at a moderate cost, for the housing of material which would be at once preserved and available for study, museums in large cities whose cost of maintenance is high being largely devoted to exhibition.

F. A. Bather described a series of 'Exhibition Labels for Blastoidea,' specially intended for the student who goes to a museum with a definite purpose of acquiring information regarding fossil crinoids. Incidentally we are given a suggestion for a dichotomous arrangement of a museum. The text of the 44 labels is given and they practically amount to a condensed text-book with the specimens serving as illustrations. No one will deny the value of such a system to the student, but would an entire museum thus planned and labeled appeal to the general public, for which, after all, the exhibition portion of a museum is intended?

The 'Reproduction of Art Objects' is treated by Robert F. Martin, who notes that Venetian glass, old majolica, bookbindings, bronzes and even tapestries are now successfully duplicated, so that art museums may by the use of these reproductions fill gaps in historical series for a comparatively small price, where originals would either cost large sums, or be quite unobtainable.

J. W. Carr explained the use of 'Photography in Museum Work' for illustrating features which could not be adequately represented by specimens alone. Among such he instanced various geological phenomena; the habits and habitat of animals; forest trees and the general facies of the landscape caused by differences in the flora.

At the business meeting of the association the question of publishing a monthly journal devoted to museum matters was the subject of a 'Report from the Council,' and while the project was not then definitely settled, it has since been decided to publish such a periodical. The details have not as yet been made public.

F. A. L.

THE SCIENTIFIC ALLIANCE OF NEW YORK.

RENEWED efforts are being made to secure an adequate building for the societies composing the Scientific Alliance of New York. Mr. J. Pierpont Morgan has made a conditional subscription of $25,000, and several smaller amounts have been subscribed. A Committee of Cooperation with the Council of the Alliance has been formed consisting of Andrew H. Green, *Chairman*, 214 Broadway, Edward D. Adams, Abram S. Hewitt, W. E. Dodge, John S. Kennedy, Andrew Carnegie, F. W. Defoe, J. Hamp-

den Robb, D. Willis James, Sam'l Sloan and John J. McCook. This committee has issued the following appeal:

The Council of the Scientific Alliance of New York, composed of delegates from the New York Academy of Sciences, the Torrey Botanical Club, the New York Microscopical Society, the Linnæan Society of New York, the New York Mineralogical Club, the New York Section of the American Chemical Society and the New York Entomological Society, is endeavoring to obtain by subscription a fund for the erection of a building for the use of these societies and others joining the Alliance.

The building is needed as a common meeting-place for the societies, which now occupy rooms in various parts of the city, for the housing of their libraries, which are now widely scattered, for a large lecture hall, for laboratories and other rooms for scientific research, and as a central point of influence upon the community.

The scientific societies are about the only agencies of modern culture for which permanent homes have not been provided in the Metropolis. In this respect New York is strangely behind many smaller cities in the United States, and suffers still more in comparison with the great cities of Europe, most of which have creditable buildings devoted to the use of such organizations. As much original scientific research is carried on in the city of New York as in any other city of the United States, and only public encouragement and support of its already very efficient societies are needed to make New York the scientific center of the country.

The Council of the Scientific Alliance has been incorporated by a special act of Legislature, with power to acquire real estate and to receive bequests. It holds as a nucleus for the present undertaking the sum of $10,000, contributed by Mrs. Esther Herrman, and a number of smaller subscriptions. It is estimated that land can be purchased and a suitable building erected and equipped for the sum of $500,000, which it is the aim of the Alliance to raise.

The undersigned Committee of Cooperation with the Council commend the undertaking and urge all public-spirited citizens to unite with them in the endeavor to bring it to a speedy realization. Subscriptions will be received by the chairman of the Committee or by any member of the Council.

MEMBERSHIP IN THE NATIONAL ACADEMY OF SCIENCES.

IN view of the fact that the National Academy of Sciences is about to hold its annual meeting at which new members are elected, it may be of interest to give the members of the Academy who have died and who have been elected during the past ten years.

	Deaths.	*Elections.*
1891.		
	Julius E. Hilgard,	None.
	John Le Conte,	
	Joseph Leidy,	
	Miers F. Longstreth.	
1892.		
	T. Sterry Hunt,	Carl Barus,
	Joseph Lovering,	S. F. Emmons,
	J. S. Newberry,	M. Carey Lea.
	Lewis M. Rutherfurd,	
	William P. Trowbridge,	
	Sereno Watson.	
1893.		
	W. H. C. Bartlett,	None.
	F. A. Genth.	
1894.		
	Charles E. Brown-Sequard,	None.
	Josiah P. Cooke.	
1895.		
	James D. Dana,	W. L. Elkin,
	John Newton,	C. S. Sargent,
	James E. Oliver.	W. H. Welch,
		C. O. Whitman.
1896.		
	Thomas L. Casey,	C. D. Walcott,
	G. Brown Goode,	R. S. Woodward.
	Benjamin A. Gould,	
	H. A. Newton.	
1897.		
	E. D. Cope,	W. H. Dall,
	M. Carey Lea,	F. A. Gooch,
	A. M. Mayer,	C. S. Minot.
	J. H. Trumbull,	E. W. Morley,
	F. A. Walker,	
	Theodore Lyman.	
1898.		
	James Hall,	None.
	William A. Rogers.	
1899.		
		Charles E. Beecher,
	O. C. Marsh.	Geo. C. Comstock,
		Theodore W. Richards,
		Edgar F. Smith,
		Edmund B. Wilson.
1900.		
	James E. Keeler,	Franz Boas,
	Fairman Rogers.	James E. Keeler,
		H. F. Osborn,
		Samuel L. Penfield.

SCIENTIFIC NOTES AND NEWS.

THE National Academy of Sciences will hold its stated annual meeting at Washington on April 16th, 17th and 18th.

THE spring meeting of the Council of the American Association for the Advancement of Science will be held in the Assembly Hall of the Cosmos Club, Washington, on Wednesday, April 17th, at 4.30 p. m.

DR. GEORGE DAVIDSON, professor of geography in the University of California, has been elected a correspondent of the Paris Academy of Sciences.

PROFESSOR F. G. HESSE, who holds the chair of mechanical engineering in the University of California, was offered a banquet at San Francisco on March 29th to celebrate his twenty-five years of service in the University of California. About 150 of his friends and former students were present and speeches were made by Professor Joseph Le Conte and others.

A PORTRAIT of Dr. W. W. Keen, professor of surgery in the Jefferson Medical College, Philadelphia, has been presented to the institution by his colleagues and students. Dr. Keen, as we have already noticed, has been granted a long leave of absence for travel abroad.

THE fiftieth anniversary of Dr. Abraham Jacobi's doctorate was celebrated at the New York Academy of Medicine on April 3d. Dr. Jacobi was introduced by Dr. R. F. Weir, the president of the Academy, and read a paper on 'German Medical Text-books of Half a Century Ago.'

PROFESSOR J. MARK BALDWIN, of Princeton University, has sailed for Europe to supervise the publication of the second volume of the 'Dictionary of Philosophy and Psychology,' which is printed by the Oxford press, and to arrange for the translation of the work into foreign languages. It is expected that the first volume will be published in a week or two.

DR. J. A. BERGSTRÖM, associate professor of psychology and pedagogy in the University of Indiana, has been given leave of absence in order that he may study the school systems in Germany and Sweden.

PROFESSOR GEORGE FREDERICK WRIGHT was given a reception on April 4th, by the students of Oberlin College, on the occasion of his return from his geological trip round the world.

E. R. CUMINGS, of the department of geology of the University of Indiana, has been given leave of absence in order to carry on his studies at the Johns Hopkins University.

MR. CHARLES P. STEINMETZ has been nominated by the Council of the American Institute of Electrical Engineers for president. In the ballot of members Mr. Steinmetz received seventy-six votes, Mr. L. B. Stillwell sixty five and Professor M. I. Pupin forty-four. The Institute will hold a conversazione at Columbia University on April 12th.

M. FAYE has been appointed president of the Council of the Paris Observatory for the present year.

M. SABATIER, of Toulouse, has been elected a correspondent in the section of chemistry at the Paris Academy of Sciences.

THE Midland Railway Company, of Great Britain, is sending two engineers, Messrs. Seeley and Woollinscroft, to the United States to study American railway methods, including the use of electricity.

MR. VAUGHAN CORNISH has returned, as we learn from the London *Times*, from an expedition in search of snow waves in Quebec, Manitoba, the Northwest Territories and British Columbia. These waves were found to be well developed on frozen rivers and lakes and on the open prairie, where photographs and measurements were taken. They are produced without the intervention of any obstruction, and sometimes occur in groups or trains of waves comprising 100 succeeding ridges. Their movement is sufficiently rapid to be readily visible. In certain conditions of the snow true ripples are also formed, which are similar to the ripples produced by wind in loose, dry sand. In both ripples and waves the steeper face is on the lee side. In moist or coherent snow, such as usually falls in England, the wind carves the surface into ridges, which have their steep face on the windward side.

MR. WILLIAM KENT, of New York City, author of 'Kent's Mechanical Engineers' Note

Book' and of 'Steam Boiler Practice,' also associate editor of the *Engineering News*, is to deliver a series of six lectures before the senior students in engineering of Purdue University, Lafayette, Ind. The lectures of Mr. Kent will extend through the week beginning April 15th and will close a long series of lectures delivered at Purdue by outside engineers.

THE death is announced of Audubon Whelock Ridgway, assistant in the Department of Ornithology of the Field Columbian Museum, Chicago. He was born in Washington in 1877, and was the only son of the eminent ornithologist, Dr. Robert Ridgway.

THE death is also announced, at Berlin, of Dr. Schlichter, the African traveler and geographer.

DR. C. R. ALLEN, vice-president of the Torrey Botanical Club, has presented the New York Botanical Gardens with his valuable collection of stoneworts.

THE *Astronomical Journal* states that the following grants from the Gould Fund have recently been made: to Mr. John A. Parkhurst, $30; to Dr. Herman S. Davis, $500; to Mr. Paul S. Yendell, $225; to Professor Simon Newcomb, $25. A considerable additional amount of income has accrued, for the distribution of which applications are awaited. These applications may be made by letter to any of the directors, stating the amount desired, the nature of the proposed investigation, and the manner in which the money is to be expended. The directors, desiring to stimulate the participation of American astronomers in the attempt to bring up the arrears of cometary research, offer to them the sum of $500 for computation of the 'definitive' orbits of comets; this sum to be distributed at the average rate of $100 for each computation—the amount to vary according to the relative difficulty of the computation, and to be determined by the directors of the Gould Fund. Computers should promptly notify the directors of their participation or desire to participate, and manuscripts should be submitted not later than July 1, 1902.

IT is stated in *Popular Astronomy* that Dr. Lewis Swift has disposed of his astronomical equipment to the Pasadena and Mount Lowe Railway. The instruments are to remain on Echo Mountain, and Professor E. L. Larkin is now director of the observatory.

DR. PATRICK GEDDES, who was responsible for the formation of the International Association for the Advancement of Science, Arts and Education, and the holding of an International Assembly at the Paris Exposition last year, proposes a similar assembly, in connection with the exposition and congresses to be held at Glasgow this year.

THE Zoological Society of London has arranged the following lectures to be held after the general meetings on Thursdays, April 18th, May 16th, June 20th and July 18th:

'On the Protection and Nourishment of young Fishes': Professor C. STEWART, LL.D., F.R.S.

'Biological Stations at Home and Abroad.' With lantern illustrations: Professor W. A. HERDMAN, F.R.S.

'Mimicry.' With lantern illustrations: Professor E. B. POULTON, F.R.S., F.Z.S.

'Rhinoceroses, Recent and Extinct.' Mr. F. E. BEDDARD, F.R.S., F.Z.S.

THE laboratory of the U. S. Fish Commission for the study of marine biology, at Beaufort, N. C., will re-open for work on the first of May, and will remain open through September. The laboratory is open to those wishing to carry on botanical or physiological work, as well as to those engaged in zoological investigations. The usual histological apparatus and reagents are provided, and the collecting outfit includes a steam launch with dredge and trawl. The more commonly used journals will be kept on file. There is no charge for tables. Applicants for tables should address Hon. Geo. M. Bowers, U. S. Commissioner of Fish and Fisheries, Washington, or Professor H. V. Wilson, University of North Carolina, Chapel Hill, N. C. Inquiries as to climate, accommodations, etc., should be addressed to the latter.

THE ship built for the use of the German Antarctic Expedition was launched at Kiel on April 1st, in the presence of a distinguished company. The vessel has been named *Gauss* in honor of the great mathematician.

THE census of France was taken on March 24th. The results are looked forward to with

special interest, owing to the small increase in the population in recent years. In the census taken five years ago the population of France was 38,517,975.

THE Navy Department for some time has been giving attention to the subject of wireless telegraphy, with a view of ascertaining how far it can be practically applied to the naval service, and Secretary Long has appointed a special board of officers to make a thorough inquiry on the subject. The board consists of Captain Chadwick, Lieutenant Powellson and Lieutenant Commander Hodgson. The meeting of these officers will take place at Newport, and it is expected that their conclusions will determine to what extent the wireless system can be utilized for the Navy.

IN order to make the free distribution of seeds by the U. S. Department of Agriculture as useful as possible, Secretary Wilson has secured authority to send out young trees as well as seeds.

THE Senate of Minnesota has passed Senator Chilton's bill prohibiting the marriage of insane, epileptic and idiotic persons, and requiring a medical certificate of all applicants for marriage licenses.

THE American Social Science Association will hold its general annual meeting at Washington, beginning on Monday evening, April 15th, and continuing four days.

UNIVERSITY AND EDUCATIONAL NEWS.

IT is said that the litigation over the Lamson estate, bequeathed several years ago to Yale University, has ceased and the University will at once receive about $450,000. Of this sum $150,000 is to be used for an auditorium and the balance for the endowment of professorships in Greek, Latin and English.

IT has been announced that the donor of the $200,000 to the University of Pennsylvania for a new physical laboratory is Mr. Randolph Morgan, of Philadelphia, one of the trustees. The laboratory will be known as the Morgan Laboratory of Physics.

THE senate of Cambridge University has accepted a tender for the erection of the new botany schools at a cost of over $100,000.

THE trustees of Harvard University have purchased about 400 acres of land near Centre Harbor, on Squam Lake, in New Hampshire, to be used as a camp where surveying will be taught during the summer months.

A ROYAL commission is to be appointed to enquire into the question of university education in Ireland.

THE Committee of Fifteen, appointed by the National Council of Education in 1898, to consider and report upon the question of a national university at Washington, will hold a meeting to formulate its final report, at Columbian University, Washington, on Thursday, May 23d, and following days. It will be remembered that the preliminary report of the Committee was adverse to the establishment of a national university, in the usual use in which the word 'university' is used; but it has in contemplation the development of a plan to make systematic use of the resources of the Government at Washington for research and investigation by university students.

THE courses in medicine for women, in connection with the University of St. Petersburg, have been closed indefinitely, owing to the recent riots in that city.

DR. G. A. MILLER, instructor in mathematics in Cornell University during the past four years, has just accepted an assistant professorship in the Leland Stanford, Jr., University, and will leave for his new field of work soon after the close of the Cornell Summer School in which he takes part. Readers of SCIENCE will recall that only a few months ago, Dr. Miller was awarded the prize offered by the Royal Academy of Sciences of Cracow for the solution of a question in groups, this competition being open to the world.

DR. C. N. MCALLISTER, assistant in the Yale psychological laboratory, has been appointed lecturer in experimental pedagogy at Yale University.

THE Trustees of Ohio State University have elected John A. Bownocker professor of inorganic geology and Charles S. Prosser professor of geology and head of the department.

SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; JOSEPH LE CONTE, Geology; W. M. DAVIS, Physiography; HENRY F. OSBORN, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; WILLIAM H. WELCH, Pathology; J. MCKEEN CATTELL, Psychology; J. W. POWELL, Anthropology.

FRIDAY, APRIL 19, 1901.

CONTENTS:

The Morphological Museum as an Educational Factor in the University System: PROFESSOR GEO. S. HUNTINGTON 601

Suggestions for an Attempt to Secure a Standard College Entrance Option in Botany: PROFESSOR W. F. GANONG 611

The Michigan Academy of Science: DR. H. S. JENNINGS 616

Scientific Books:—
André's Traité d'astronomie stellaire: PROFESSOR EDWIN B. FROST. *Barracleugh on the Steam-engine Problem:* PROFESSOR R. H. THURSTON. *Gregory's Catalogue of Fossil Bryozoa:* J.M.N. *Thorndike's Human Nature Club:* J. J. *Books Received* 618

Scientific Journals and Articles 622

Societies and Academies:—
New York Academy of Sciences, Section of Biology: DR. HENRY E. CRAMPTON. *Section of Astronomy, Physics and Chemistry:* DR. F. L. TUFTS. *Onondaga Academy of Sciences:* PHILIP F. SCHNEIDER. *The Academy of Science of St. Louis:* PROFESSOR WILLIAM TRELEASE 623

Discussion and Correspondence:—
Resignations from the School of Pedagogy of New York University: PROFESSORS SAMUEL WEIR, EDWARD F. BUCHNER, CHARLES H. JUDD. *The Proper Name of the Alpine Chough:* DR. P. S. SCLATER 626

Notes on Inorganic Chemistry:—
Atomic Weight Standard; Action of Alcohol upon Metals: J. L. H 627

Current Notes on Physiography:—
The Illinois Glacial Lobe; The Albany Mountains; Reversion in River Development: PROFESSOR W. M. DAVIS 628

Current Notes on Meteorology:—
Quarterly Journal of the Royal Meteorological Society; The Old Yuma Trail; Hann's Lehrbuch der Meteorologie; Notes: R. DEC. WARD 629

Science and Industrial Competition: PROFESSOR R. H. THURSTON 631

The Malaria Expedition to Nigeria 632

Concilium Bibliographicum 633

Scientific Notes and News 634

University and Educational News 640

*THE MORPHOLOGICAL MUSEUM AS AN EDUCATIONAL FACTOR IN THE UNIVERSITY SYSTEM.**

THE educational value of the modern morphological museum has of late years received such general recognition that we may well regard its position as established in the university system. Not only do the departments of undergraduate instruction draw more and more extensively upon this portion of the university equipment for the illustration of courses and demonstrations, but the museum itself has assumed its proper relation to independent scientific research and to the investigation of biological problems. It has seemed to me desirable to present to this association—whose members are so largely both teachers of anatomy and investigators of the science—some account of the progress made during the last decade in museum work in the department of vertebrate morphology. More especially does it appear proper at this time to note the present stage of development of the modern anatomical museum, because we have, I think, reached a period at which we can look back over a series of busy years and gauge correctly the value of the results obtained, as well as forecast the probable future development of this work. Ten or fifteen years ago the morphological

* Address of the President before the Association of American Anatomists at the Fourteenth Session, held at Baltimore, Md., Dec. 27–28, 1900.

museum—established on lines of modern thought and research—existed in an embryonic form in only a few of our institutions of learning. From this period date a number of excellent monographs—in which the authors outline the plans of a proposed anatomical museum designed to meet the requirements demanded by the advance of the biological sciences—from the standpoint both of the teacher and the investigator. Prominent among these interesting publications are the following:

'Outlines for a Museum of Anatomy. Prepared for the Bureau of Education,' by R. W. Shufeldt. 1885.

'Die Aufgaben der anatomischen Institute,' by Professor A. Koellicker, 1884. An address delivered at the opening of the new anatomical institute in Würzburg on November 3, 1883.

'The Educational Museums of Vertebrates,' an address before the Section of Biology of the American Association for the Advancement of Science, at Ann Arbor, August, 1885, by Professor B. G. Wilder.

'The Synthetic Museum of Comparative Anatomy as the Basis for a Comprehensive System of Research,' by John A. Ryder, Professor of Comparative Embryology at the University of Pennsylvania, Philadelphia. 1893.

As I look over the list of these and other contributions to the literature of the anatomical museum I am tempted to characterize the period between 1885 and 1895 as the prophetic era, foreshadowing the establishment and recognition of the most essential and valuable aid to scientific anatomical instruction and research which our universities to-day possess. When we analyze the great and radical changes which our methods of morphological teaching have experienced since that time, we shall, I believe, agree that the demonstrative and objective instruction which has replaced so largely the old didactic lecture is intimately and organically connected with the evolution of the modern anatomical museum. It will perhaps best serve the purpose of my communication if in the following I confine myself to the facts as they are most familiar to me in the case of my own university, which, I believe, may fairly be taken as a concrete example of the general progress which has marked the period in question in the scientific institutes throughout our country.

The establishment of a museum of vertebrate comparative anatomy, on lines designed to illustrate and demonstrate to the fullest extent possible the morphological truths embodied in the doctrines of evolution, heredity and descent is an undertaking requiring years of careful and successful work before even a satisfactory beginning is made. The foundation of the museum at Columbia University was laid in 1889, and, while in many directions our progress has been rapid and the results gratifying, yet we feel that to-day but the outlines exist along which future growth is to take place.

I. PLAN AND SCOPE OF THE MUSEUM AND ITS RELATION TO ANATOMICAL INSTRUCTION.

I may in the first place call your attention to the general plan and purpose of the museum, in accordance with which the objects have been collected and prepared, and to the relation existing between the museum and the undergraduate instruction in anatomy.

The following considerations present themselves:

1. The fundamental plan of the museum includes in the first place a general exposition of the vertebrate classes, whose purpose is to present the cardinal points in the anatomical structure of the great vertebrate classes and subclasses.

Each vertebrate class, subclass and order

is represented by one or more typical forms in preparations illustrating as fully as possible the skeletal and locomotory apparatus, the circulatory and nervous systems, and the alimentary, respiratory and uro-genital tracts.

This display forms the guiding thread to the study of the individual forms—in respect to typical structures, *i. e.*, the fundamental anatomical characters of the mammal, bird, reptile, amphibian and fish are grouped together to afford a comprehensive view of the entire organism, from which starting point the detailed investigation of characteristic structures in their various modifications is to be followed through the series of species belonging to the *same class*.

To illustrate: the typical structure of the avian pectoral girdle is represented in the collection by the girdle of *Palamedea cornuta*, the horned screamer. It is here shown to contain three elements, the scapula, coracoid and furcula.

Turning to the corresponding series demonstrating the successive modifications of this structure, we find it as a link in the group devoted to the development of the vertebrate shoulder girdle. The various modifications in shape, extent and sternal attachment of the complete furcula are first illustrated, together with preparations of the membranous and ligamentous structures, which have a bearing on the general morphology of the episternal apparatus.

In the next place the avian girdle is found to pass from the type represented by *Palamedea*, in which all three skeletal elements are fully developed, to the intermediate condition seen in the toucan, where the furcula is developed as a bilateral structure, the two segments not fusing over the sternum, until we come to the brevipennate group of birds, of which *Dromæus* still has rudimentary anterior collar bones, whereas in *Struthio*, *Rhea* and *Casuarius* these have lost their identity by becoming fused with the scapula.

In the second place this division of the museum affords the basis for broad comparison between the organizations of the different vertebrate classes. For example, the comparison of the entire anatomical system of a typical reptile, bird and mammal will show why reptiles and birds, although differing widely in structural detail, yet have sufficient general morphological characters in common, as against the mammal, to entitle them to be grouped under the single broad head of the Sauropsida.

Then again, this portion of the museum is designed to elucidate the important problems of derivation of vertebrate sub-classes.

2. The second main division of the museum deals with the development, evolution and comparative structure of single organs and systems. The homologies in the different classes, and the modifications of the typical structures in each class, are here demonstrated as completely as possible. In many respects this portion of the work is educationally the most important. We draw most extensively upon it for our anatomical undergraduate instruction in the elucidation of problems in human morphology. I cannot take time in even superficially outlining the detailed development of this division of the anatomical museum. The enumeration of a few of the principal series must suffice.

I may instance the series dealing with the morphology of the alimentary tract, and especially the group devoted to the structure of the ileo-colic junction, cæcum, vermiform appendix and the allied segments of the large intestine. This series, including at present over 600 preparations, and beginning with type forms illustrating this portion of the alimentary canal in fishes, amphibia, reptiles and birds, passes to a complete demonstration of the structures in mammals, terminating with several speci-

mens of the four anthropoid apes and leading up to the detailed study of the human cæcum and appendix, the numerous variations of which are all represented by one or more type specimens. In the same way the various forms of the stomach and the modifications of small and large intestine constitute a series of great morphological interest.

Other series deal with the vertebrate respiratory apparatus, especial stress being laid on the clear demonstration of the development, evolution and structure of the mammalian lung. Closely connected with this group is the serial exhibit dealing with the heart and circulatory system. Other series include the nervous system, the genito-urinary tract, the pelvic and pectoral girdles, the mammalian temporal, periotic and tympanic bone, etc.

Special attention is given in this department of the museum to the demonstration of human anatomy. Eventually it is hoped that every portion of man's structure will be fully and exhaustively illustrated by perfect preparations. The museum should afford the medical student the opportunity of directly verifying his text-book information and should be a most valuable guide and aid to the practical anatomical study of the individual in the dissecting room. Moreover, many structures, as we all realize, are never fully examined or completely demonstrable to the student in the dissecting room. Aside from the individual differences in the cadaver in respect to development and state of preservation, and in the element of alteration of structure by diseased conditions, certain parts require special methods of preparation, such as the auditory apparatus; others necessitate for their exposition the sacrifice of surrounding structures to a degree not warranted by the practical requirement of getting the greatest amount of detail from the dissection of a single cadaver. Moreover, even the structures, which are ordinarily fully examined and demonstrated in the dissecting room on the fresh subject, can be shown with great profit in the museum in various preparations by different methods. For example, the museum contains hardened situs preparations, organs hardened, distended and fenestrated, injection and corrosion preparations, etc., to illustrate fully the anatomical structure of each part and to enable the student to extend and amplify his observations on the cadaver.

Again, in connection with this department of the museum, I find it of distinct advantage to establish small comparative series designed to illustrate the development and normal anatomy, as well as the more important variations, of certain adult human conditions. These groups are accompanied by tablets, describing as fully as necessary the purpose of the exhibit, and drawings which emphasize the points at issue.

Thus, for example, under the heading of the cardinal sinus of the adult human heart —as part of the series exhibiting cardiac anatomy--the following group is placed with full explanatory text:

1. Heart and vascular system of *Raja ocellata*—various preparations to show embryonic type of mammalian heart before septal division, ducts of Cuvier and symmetrical cardinal veins.

2. Heart of *Python molurus*—hardened and distended, with sections showing: (*a*) sinus venosus of right auricle; (*b*) valves of sinus venosus and their relation to the Eustachian and Thebesian valves of the mammalian heart; (*c*) pulmonary veins; (*d*) persistent left precava.

3. Heart of *Struthio africanus*—injected, showing persistent avian left precava—with its relations to pericardium and coronary vein.

4. Ruminant heart (*Antelope cervicapra*) —mammalian type of normal persistence of left precava.

5. Series of normal human hearts—showing, in various preparations, coronary sinus, Thebesian and Eustachian valves—both fœtal and adult.

6. Series of well-developed folds of Marshal in fœtal and adult hearts.

7. As soon as obtained the final member of this group will be added as a preparation showing the normal persistence of the left precava in the adult human subject.

Instances in which a similar limited and selected group of preparations may be with advantage established for the elucidation of special details in human anatomy could be almost indefinitely multiplied.

I have noted at random:

1. Development of axis and atlas.

2. Ligaments and tendons of shoulder joint.

3. Greater and lesser sciatic ligaments and relation to hamstring muscles and coccygeus.

4. Postcava and variations.

5. Carpus and tarsus.

6. Sacrum and vertebral variations.

7. Aortic arch and variations of primary branches.

8. Various myological problems.

9. The peritoneum.

The question as to the practical application of this educational material to the requirements of undergraduate instruction in anatomy deserves careful consideration from several points of view:

1. Primarily the museum should afford a consecutive and logical serial exhibition, arranged and administered in such a manner that for both undergraduates and advanced students the preparations should be readily accessible and capable of being examined with only such restrictions as the safety of the object demands. The museum should be the reference library of the student in the widest sense, where the undergraduate can review and extend his anatomical knowledge on the hand of the actual object of his study, and where the advanced worker will find the necessary material in directing and supplementing his research in any given problem under investigation.

2. In the demonstrative teaching of the anatomical course the material of the museum in our experience can best be utilized in two ways:

a. It is our custom, in approaching any one of the large subdivisions of the course—such as the respiratory and circulatory system, the alimentary canal or genito-urinary tract—to devote a portion of the available time to a preliminary general consideration of the development, peculiarities of morphological structure and the physiological significance of the parts involved. For this purpose a judicious selection of a limited number of the museum preparations is made, and the objects are arranged in the form of a series, each number of which distinctly and forcibly illustrates a developmental stage or a significant and important structure or functional fact. It is necessary to limit the preparations thus selected in number to avoid confusion and superfluous expenditure of time, but it is surprising how clearly and convincingly the main broad lines of vertebrate development and evolution and the relation between structure and function can be brought out in a comparatively short series of selected preparations. Every teacher knows and appreciates the difference in the quality of instruction and its results between a demonstration of models and drawings, schematic or otherwise, and one referring directly to the natural object. The most important function of the museum, as an integral part of the educational system of the university, is exerted in supplying the material necessary for this kind of demonstrative teaching. Practically I find in the schematic blackboard sketch or the more carefully

prepared colored chart a most valuable adjunct. The drawing should, however, be made directly from the actual preparation demonstrated and the student should have the opportunity of directly comparing both. In this way salient points can be accentuated and the attention properly and immediately directed to the important facts which the preparation is designed to illustrate.

b. In connection with the class-room demonstration it is at times desirable to deal with general problems of vertebrate morphology from the higher standpoint which, on the hand of a more extensive series, affords a wider view of the structures concerned. I find that this can best be accomplished by a photographic lantern slide demonstration, in which a very considerable number of forms can be exhibited to the class in a comparatively short time. It has been our practice to photograph the preparations when finished, but before they are permanently mounted or included in the museum series. As a practical matter the best results are obtained by vertical exposure, the object being placed in suitable trays and covered by clear fluid—water or alcohol. In this way the disadvantage, resulting from the distorsion and reflection of the jar containing the specimen when finally mounted, is obviated.

The resulting photograph forms part of the museum record and is useful in many ways. Properly labeled, it forms an excellent guide to the study of the preparation and it can be used directly for reproduction in publications or be made the basis of the drawing. Finally, as the completion of the series warrants it, the negatives yield a set of lantern slides which can be used in the teaching of the department as well as in extending the use of the museum material in other institutions.

3. The special courses in comparative anatomy and embryology, which are offered as optionals, electives, or for the higher university degrees, make demands which the museum should meet as fully as possible. In the first place, I find that the forms which can readily be obtained in numbers, and supplied to the students for their actual personal use in the laboratory courses, require in many cases comparison with allied types which, by reason of their rarity and value, can only be represented in the permanent collection of the museum. The courses can thus be extended and made infinitely more valuable and instructive. Again, every practical laboratory teacher will know the value of placing before the student a carefully and clearly executed preparation and reviewing the structures which he is to expose and determine for himself by the dissection of the fresh material on hand. This use of the museum is entirely apart from the valuable and instructive deductions which a series of significant variations of normal structures will enable the student to make.

Moreover, in many respects the museum fulfills one of its most important practical functions in enabling the teacher to direct the student's attention, at the proper points in any laboratory course, to the corresponding structures and their modifications in selected preparations ranging throughout the entire vertebrate series. The broad and general application of the knowledge gained by the detailed study of any individual form can only by these means be impressed on the student, and it is thus that the anatomical museum accomplishes one of the main purposes of morphological study.

II. Relation of the Museum to Original Research and Advanced Study.

Of equal importance with the value of the museum for undergraduate instruction is its influence in promoting original investigation and advanced morphological study. Its very existence carries this with it. It constantly opens up, in creating the

nucleus around which the institution is to grow, lines of investigation and research which ultimately return their products to the museum as permanent records of the work accomplished, and thus prove sources of continual and valuable additions.

The museum in itself forms the basis for a progressive extension of morphological investigation. It accomplishes this in several directions. In the first place, the generalization of the structures presented by different types, which marks the central purpose of the institution, forms a circle from whose circumference at any point the line of a new and more extended investigation can be drawn. In fact, if the museum is to grow and develop according to its original intent, it is requisite that such enlargement should take place.

As the museum grows the vital questions of derivation and ancestry of forms must be investigated on the hand of constantly increasing material, which will open up points of view heretofore unattained. With each new accession to any group the capacity of the museum for extension of original thought and investigation increases. Any research opens at some point in its course side lines which may be of the utmost value. It is here that the immediate possibility of serial comparisons on a large scale afforded by the museum becomes of the greatest importance. The museum represents in its complete condition a morphological reference depository. It functions in connection with the morphological library, but it possesses the inestimable advantage of presenting the actual objects instead of plates and descriptions, often at variance with each other, incorrect and incomplete in detail and failing to elucidate just the question which it is desired to solve.

In this sense the museum fulfills its highest functions, stimulating and directly promoting investigation and rendering such investigation fruitful and effective by contributing the series necessary for comparison and reference.

It may hardly be necessary to touch on the effect of this work on those who are engaged in it. It attracts men whom the university is glad to number among its students and graduates, and who in other institutions—as teachers and investigators—will reflect credit on their training. If from among the growing numbers of our medical students even a few are made to develop into scientific workers, I should yet hold those few—in their prospective value to the university and to science—as balancing the long list of medical graduates whom we annually send out at our commencement.

III. RELATION OF THE MUSEUM TO OTHER DEPARTMENTS OF THE UNIVERSITY.

There is scarcely a department of biological or medical instruction and investigation which is not in intimate relation with some portion of morphology, and which will not benefit by a connection with the museum and by access to its collections.

In physiology, the science dealing with the function of the machine which itself is the object of the study in morphology, the connection is obvious. But the tremendous advantage which will accrue to each of these sciences by closer mutual association, through the link of the comparative anatomical museum, can scarcely be estimated. Morphology offers in the series of modifications which different forms present in their structure, a field of nearly unlimited choice for the interpretation of the physiologist. The physiological study of an organ in a certain form—as the dog—may lead the investigator to certain results which apply in the first plan to the species examined. If now the morphology of the organ is accessible to the physiological investigator not only in a complete series of

the dog's own order, the Carnivora, but through the entire mammalian class, and beyond this limit, so as to include the homologous structures, in other vertebrate classes, the result of the investigation becomes potentially amplified to a corresponding degree. The investigator can not only reason from analogy as to the results of similar experiments extended as far as deemed advisable through the vertebrate classes and orders, but he can also, guided by the morphology of the structure under consideration, select types which, from their anatomical configuration, promise unequivocal confirmation and extension of the results yielded by the first experiment. How frequently the success of an investigation depends on details of anatomical structure every physiologist will attest. It is often the question of the length of an arterial vessel without branches, or the arrangement of a duct, or the combination of several peripheral nerves. The museum of comparative morphology converts a haphazard search for a suitable form into one which will select the most desirable type with certainty.

In turn the generalized view of organized structure obtained in the comprehensive system of the museum will afford to the morphologist the aid which is to be found in the broad physiological interpretation of the modifications exhibited. Thus these two fundamental departments will be brought into closer contact with each other, a contact which cannot fail to redound equally to the benefit of both. I believe that a closer association of anatomy and physiology, such as is afforded by the link of the museum, is of very distinct advantage in undergraduate instruction. The modern development of science inevitably leads to a high degree of specialization, which naturally becomes apparent in the teaching of any department. The general advantage of this is obvious, provided touch is not lost with cognate branches. The morphological museum preserves this vital connection between anatomy and physiology more than any other single factor in the university equipment. Moreover, the museum has important relations to the practical departments of medical teaching and to pathology. Nearly all important advances, especially in departments such as diseases of the eye and ear, the diseases of women, surgery in general and in its specialized branches, depend primarily on some morphological question for their inception, rendering this or that proposed operative interference proper and advantageous, or interdicting it.

A museum which offers to the medical specialist not only the normal and variant human structures which constitute his field of work, but which enables him at the same time to examine the homologous parts of other vertebrates for the purpose of gaining clearer insight into obscure morphological conditions and the origin of aberrant formations, will certainly be an aid to practical advance which can be obtained by no other means. It is needless to point out further connections of a similar character, or to more than touch upon the line along which pathology and embryology meet, a line which is sufficiently extensive, but obscure because the assistance which vertebrate embryology can afford to the pathologist is only rarely attainable in the form which the museum proposes to offer, viz., complete sets of serial preparations. As the museum develops it is proposed to take successively certain portions of the subject, such as eye, ear, larynx, brain, genito-urinary tract, etc., and to develop these as fully as possible, demonstrating the results in the form of an exhibition to a selected number of scientific men who are directly interested in the matter as expert specialists. The importance of this feature of the museum work will thus be brought more

particularly to the attention of those best able to judge of its value and to profit by the same. I have no doubt that from this class of men valuable work in investigation will be secured.

IV. UTILIZATION FOR THE PURPOSES OF THE MUSEUM OF THE MATERIAL OBTAINED FROM THE DISSECTING ROOM, AND REFERENCE COLLECTION IN OSTEOLOGY.

The question has at times been discussed whether the morphological museum should take its place in the university system as part of the departments of general biology and zoology, or as an integral division of the department of anatomy in the medical school. I am unhesitatingly of the latter opinion. Aside from the obvious relation to undergraduate medical instruction which I have attempted to outline above, the mere fact that man, the highest vertebrate of the series, forms the object of study in the medical curriculum, assigns to the morphological museum its logical place in the university system. The human material necessary for the completion of the museum series is to be obtained from the supply of the medical school. The typical preparations are, of course, from specially selected subjects set apart for the purpose. Besides this, however, one of the important functions of the museum is to supervise the records of the dissecting room, to collect and arrange the statistical information afforded by the constantly repeated examination of the human body, to acquire for its own purposes the preparations which either illustrate normal structures unusually well or demonstrate important and significant variations. Part of this material is capable of direct incorporation in the museum series after removal from the cadaver and proper preparation. For other objects the method of plastic reproduction by means of casts is invaluable. This applies especially to the great group of myological variations. Not only are the objects bulky and not well adapted for preservation as moist specimens, but casts actually better serve the purposes of the museum in exhibition and instruction. In the comparative myological series, with which human muscular variations are necessarily brought into intimate relation, the method of plastic reproduction is an essential. The full utilization of rare and valuable animals requires this method because superficial structures must be removed before the deeper parts can be reached. As the superficial muscles are exposed casts of the different regions are taken in various positions. In the same way, by casting the deeper layers as they are successively reached, permanent records of the greatest value for myological study and reference are attained. The casts, together with the notes and drawings of the dissection, form a complete and readily accessible record far exceeding in value and accuracy any other method of illustration. Again, for example, in dealing with the development and modifications of the extremities in the vertebrate classes, each group is accompanied by casts of the entire hand and foot, forming, together with the preparations of the soft parts, muscles and ligaments and the skeleton of the extremities, a complete series. For purposes of instruction this method has proved itself very valuable. Thus a carefully prepared and hardened liver showing the natural surfaces and impressions, which are ordinarily lost in the organ removed from the body before hardening, and which are hence not ordinarily recognized, has been cast and reproductions prepared in sufficient numbers to allow one to each student for personal examination during the demonstration of the organ to the class. This plan, when extended as purposed by the museum, will vastly add to the effect and value of our demonstrative teaching.

The development of the facilities for plastic reproduction of morphological objects enables the museum to enter into connection with other institutions for purposes of exchange and scientific intercourse.

In connection with the utilization of the human material for the museum I desire to mention briefly the Reference Collection in Osteology, as part of the plan of offering opportunities for extensive morphological and anthropological research. This collection includes:

1. The disarticulated skeletons of vertebrate animals.

These are kept in boxes, arranged like the books of a library, accurately catalogued and indexed, so that any desired skeleton can be immediately found and used. The collection is placed in the osteological laboratory. It is proposed to make the collection thoroughly representative, and to include sufficient individual specimens of each form to avoid erroneous deductions possibly based on unusual variations.

2. The department includes, in the second place, a reference collection of human bones, on a scale which renders possible a thorough comparative study in reference to racial character, variations, reversions, age and sex differentiations, etc. The collection is now approaching the limit which we originally designed for it, viz., 5,000 specimens of each of the bones of the human body, but will be extended beyond this point. I am gratified that this material has afforded one of our members, Dr. A. Hrdlicka, opportunity for some very interesting researches, some of which have already been presented to this association, while his more recent results are to come before us at this meeting. The value of the collection is greatly increased by our system of record-keeping, which makes the material available for anthropological study in the widest sense. We obtain now, from the hospital records, the necessary data as to parentage, age, birthplace, etc., of each subject delivered at the college. These data are entered upon the record under a running number, which follows each bone on a lead tag through all stages of maceration and preparation until it is turned into the reference collection as finished. Consequently this collection does not represent merely a catacomb of human bones indiscriminately packed together, but each bone, with its origin and history clearly indicated, becomes a member of a series available for scientific comparative work.

The same system is applied to all variations of the soft parts obtained from the dissecting room, and the variation collection of the general museum becomes in a like manner the means of promoting scientific inquiry into the causes and conditions at present operative in human evolution.

V. DEPARTMENTAL LIBRARY.

I may merely mention that a good working morphological library, containing the standard works and the more important current periodicals, forms part of the accessory equipment of the museum.

VI. LABELING AND CATALOGUE.

In conclusion I may briefly refer to the method of labeling and cataloguing the collection which we have found most useful.

The catalogue is divided into the *general* and *accession catalogue*. Each specimen as received is given an *accession number*. On the card slip, corresponding to the number in the accession catalogue, are entered all the data concerning the animal, as source of supply, date of receipt, weight of body and of individual parts, presumable age, sex, method of preparation, individual peculiarities, etc., and finally a complete list of the finished preparations derived from the

animal as they are incorporated in the museum.

The general catalogue carries on each card the running number of the preparation and beneath the same the accession number of the animal from which the specimen is taken. It is thus possible, while avoiding needless repetition, to ascertain at once the details concerning any preparation by reference to the accession catalogue. The cards of the general catalogue are arranged in accordance with the serial exhibition of the museum. The running number of the general museum and the accession number appear on the label of each preparation. In addition the individual preparations carry two small disks of a bright color with a number. These are the complementary numbers of the preparation, referring it to some other group with which it is related, as well as indicating its position in its proper series. For example, the shoulder-girdle of the armadillo assumes its proper place in the series demonstrating the structure of this portion of the vertebrate skeleton, and is numbered accordingly on a green disk, so that its own place in the series is preserved, green being the color of that division of the museum which deals with the development of the pectoral and pelvic arches. If the armadillo's number in the series is 17, and an additional preparation enters the series next to it, it receives green number 17a, etc.

In addition to the green number a small red disk on the armadillo preparation carries a number which refers the preparation to its proper place in the series illustrating the general anatomy of the Edentates, red being the serial color of that division. So if it is desired to put together at once for comparison all the material contained in the museum for illustration of the Edentate type, every preparation carrying a red disk is taken out of its own series and the resulting group, when arranged in the sequence of the red numbers, forms the logical series treating of Edentate anatomy.

This plan makes every portion of the museum easily and at once accessible, and arranges the series in such a manner that each shall prove complementary to all the others.

By varying the shape of the colored labels and the character of the numerals sufficient range is obtained to meet all requirements.

In addition—as the series develop—more extensive typewritten tablets are introduced, giving the general features of the group and indicating the purpose for which it was assembled.

Photographs and drawings of the preparations, carefully labeled, are used for indicating points of special importance, in such a manner that they can be readily identified in the actual preparation. These accessories prove of aid in the use of the museum for individual study and during informal demonstrations and conferences.

I have attempted to outline for your consideration the present status of the morphological museum and its relation to the system of the university. I am convinced that the practical value of the institution will continue to make itself more and more felt, and its general adoption and development will be one of the prominent features marking our educational and scientific progress during the next decade.

GEO. S. HUNTINGTON.
COLUMBIA UNIVERSITY.

---

*SUGGESTIONS FOR AN ATTEMPT TO SECURE A STANDARD COLLEGE ENTRANCE OPTION IN BOTANY.**

THE rapid advancement of any science depends not only directly upon the re-

* Read before the Society for Plant Morphology and Physiology at the Baltimore Meeting, December 28, 1900.

searches of specialists, but also indirectly upon a favorable public opinion. Something may be done towards forming this opinion through a wide dissemination of information as to the true aims of science, but a more efficient method consists in the proper education of the coming public while it is still in school and college. From the single point of view of the advancement of his science, therefore, and apart altogether from the question of his responsibilities towards general education, it is the duty of every scientific man to contribute according to his ability towards elementary scientific education. Particularly is it the duty of every one of us connected with educational institutions to inform ourselves upon the present status and problems of this subject, and vigorously to set forth our resultant opinions upon all fitting occasions. It follows, further, that the problems of elementary scientific education are a proper subject for the consideration of any scientific society.

In these days the sciences are making great advances in education, and they are approaching, though for the most part they are still far below, the educational level of the older subjects. Amongst the sciences botany holds at present a less prominent place than it deserves; but, under the vitalizing influence of the dynamical and realistic spirit so recently infused into the subject among us, it is advancing to a greater prominence for the near future. Just at present, in botany as in many other subjects, educational discussion hinges chiefly about the contact of school and college, that is, about college entrance requirements. From this discussion three distinct educational advances are resulting: First, wider options in entrance subjects generally; second, a greater emphasis upon the sciences; and third, a determined movement to secure greater uniformity in the requirements made by different colleges in the same subject. With the first of these advances we are not here concerned except to express our approval. In the second we have a more direct interest, though it is not in discussion in the present paper. I take it for granted we are all agreed that science should form an integral part of the education of every individual from the kindergarten to, into and in the college, and that botany should hold among the sciences the place to which its nature entitles it. Apart, however, from the abstract merits of the case, it is a fact that some of the leading colleges of the country do now either require a science for entrance, or else will admit the sciences as options, sometimes even to the amount of one-third of their total entrance requirement. Some schools are already teaching sciences well, and under the stimulus of a wider acceptance of their results by the colleges, such teaching will unquestionably both further improve and widely spread. We cannot doubt, therefore, that the present movement is towards the general acceptance by the colleges of the sciences, with botany among them, as options, if not as a requirement, for entrance. If, in the colleges with which we are connected, the sciences, including botany, are not accepted for entrance, it should at least not be through default of vigorous championship upon our part.

It is, however, with the third advance mentioned above, namely, with the effort to secure uniformity in requirements in the same subject, that we are now immediately concerned. It is well known that the varied demands made by different colleges in the same subjects impose a most serious burden upon those preparatory schools which prepare students for several colleges, requiring multiplication of classes, division of resources, waste of energy, and, worst of all, a too great subordination of true education to preparation for the passing of examinations. This mal-adjustment of preparatory schools

as a whole to colleges as a whole constitutes one of the most serious educational problems of the present time. So serious is it that not only has the National Educational Association given its best energies for some years past to the endeavor to formulate standard national courses, but associations of colleges and preparatory schools, with large and influential membership, have been formed chiefly to grapple with it. All these efforts, be it noted, are not at all toward a uniform total requirement for all colleges, but simply toward a uniform general mode of treatment of each particular subject, and the colleges are left as free as before to make any desired permutations and combinations of subjects. The most important and practical step of all in this direction has recently been taken in the formation of the College Entrance Examination Board of the Middle States and Maryland, which is to have charge not only of the specifications of requirements in the individual subjects, but also of the uniform administration of those requirements through its own examinations. Steps have been taken, also, looking to the formation of a similar board for the New England States. Requirements have already been formulated by the former board in several subjects, but not yet in botany. Now, a question of immediate interest to us is this, what is to be the requirement adopted by these boards in botany? One would naturally expect that the course outlined by the Botanical Committee of the National Educational Association would be adopted; but this course, although embodying many good features, is not adapted, nor was it intended, for immediate practical use. If the formulation of new courses is left to the advisers of the board for the Middle States and Maryland, and to the New England Board, and to similar boards elsewhere, it is unlikely that uniformity will be secured; for such boards, like individual colleges, will not only probably be shy of accepting one another's requirements *in toto*, but also each board will be swayed by the particular views of the most prominent teacher consulted. On the other hand, a course carefully and comprehensively formulated by some central and representative scientific association, based upon the best of the previous work done in this direction, and elaborated with the cooperation of the leading teachers and of other botanical organizations throughout the country, will stand a chance of wide acceptance, and perhaps, too, is likely to be a better course than a more limited body could develop. Such a course must obviously be widely accepted in order to be of real use; but, once firmly established, it will not only permit schools to concentrate their energies upon a single and excellent method of preparation which will allow any student to enter any college and give a good education to those who do not, but also at the same time it will constitute a sort of standard of comparison and measure of value, a definite ideal towards which ambitious schools may work, and a stimulus to other colleges to adopt botany among their entrance subjects. It is the object of this paper to propose that this society undertake the formulation of such a standard or uniform entrance option in botany, and take steps to secure its adoption.

It remains now to note briefly what we have to build upon in such a formulation, what conditions must be taken account of, and what practical steps may best be taken.

The idea of a standard entrance option in botany is far from being new. It was implied in the well-known report of the Committee on Secondary School Studies of the National Educational Association (commonly known as the Committee of Ten). The recommendations of the botanical section of that committee had without doubt a powerful influence upon botanical teach-

ing in this country, and that they were not more widely adopted was due partly to the then transitional state of botanical teaching, and partly to difference of opinion as to the wisdom of some of its recommendations. The discussions of the same Association led in subsequent years to the exposition of the idea of standard entrance options, and these are set forth with the greatest clearness in the report of the committee on college entrance requirements of that Association published in July, 1899. Now, if the course in botany recommended in that report were adapted to immediate use, and if it had the approval of the majority of teachers, there would be nothing left to be done except to urge its adoption. In fact, however, whatever we may think of the merits or demerits of the course, we must all agree that it is impracticable at present for the great majority of schools. That course, with its great emphasis upon ecology, represents an extreme reaction from the old formal systematic studies, and, as is usual in such cases, the truth will doubtless ultimately be found to lie between the extremes. I had myself the honor to be consulted in the preparation of that report and gave my adherence to it as to an ideal scheme to be worked towards rather than as one to be brought into immediate practical operation. What is needed at present, however, is a course which, while setting a high and stimulating standard of intellectual work, can be brought practically and profitably into operation in the immediate future.

It will help us to understand the situation if we glance at the status of botany as an entrance subject in a few of the leading colleges. Those which follow are selected partly at random and partly because their announcements happen to be at present accessible to me, but doubtless they are fairly representative. *Bryn Mawr* requires a science, which may be botany, from all students, but the amount is small; apparently no sciences are accepted as options. *Chicago* accepts botany, a year's preparation, as a free option, counting 1 out of 15 points, and will accept 4 out of 15 points in sciences. *Columbia* accepts sciences as options up to 3 points out of 15, of which botany may count 1 point. *Cornell* accepts a science, which may be botany, as an alternative for the otherwise required mathematics. *Harvard* requires a science, which cannot be botany, counting 2 out of 26 points for entrance to the college, and will accept 7 or 8 points of sciences as options; botany, however, is accepted to count 1 point out of 21 for entrance to the Lawrence Scientific School, for which 5 points in the sciences out of 21 will be accepted as options. *Johns Hopkins* requires a science, which may be botany, but the amount required is small. *Leland Stanford* accepts 5 points out of 15 in sciences, of which botany may be one, counting 1 point. *Michigan* requires a year of physics absolutely of all students, and in addition accepts three years of science, of which botany may occupy either a year or, in combination with zoology, a half year. *Minnesota* appears to accept $5\frac{1}{2}$ points out of 15 in sciences as options, of which botany may count as $\frac{1}{2}$ or 1 point. *Nebraska* accepts 7 points in sciences out of 28 as options in one college; of which botany may count 2 points: and requires 3 points in the sciences, of which botany may be 1 point in the other college, and in the latter apparently 7 points in addition may be taken as options. *Smith* will accept the equivalent of 5 points out of 15 in the sciences as options, of which botany may count either as 1 point for a year of preparation or as 2 for two years, preparation. Of other colleges, some do not accept any sciences at all, while a few others which accept some of the sciences do not include botany among them. It appears, also, as would be expected, that the

liberal acceptance of the sciences is more common in the Central and Western than in the Eastern States.

The limits of my time will not permit even a summary of the preparation called for by the above-mentioned colleges, and it must suffice to say that this ranges from requirements little more than nominal up to some which are satisfactory in plan and scope. One characteristic which most of them show is a great liberality in the details of preparation, amounting in some cases practically to the acceptance of any good course. All this indicates a very undifferentiated condition of botanical teaching among us, a fact which, along with its many drawbacks, has at least this advantage from our present point of view, that it will be much easier to secure the adoption of a standard course than would be the case if the teaching were more differentiated. Although the preparation required appears at first sight to be very different for the different colleges, closer study shows that there are many common features, and these will form the natural and excellent foundation for the new course.

The ideal position for botany in the entrance curriculum, indeed the position towards which it seems in the most progressive institutions to be tending, is this: any college which requires any number of particular subjects should require a science; every college should accept as options enough of the sciences to allow a student thus to utilize four years of thorough high-school work in the sciences; botany should be included among these sciences; the preparation should be of such a character that it will yield a training fully equal to that afforded by any other subject studied for the same length of time, and will admit the student to second courses in college.

It will be agreed, I think, that the formulation and successful working of a standard entrance option is a matter of much importance to us. But no such course can be formulated, much less brought into use, unless all teachers approach it in a friendly and cooperative spirit, each willing to yield some of his own individual views for the sake of the common good. It must be in the nature of a compromise, though it is by no means necessary that it shall represent a composite of all existent views. It must of course be elastic enough to allow full play to individual methods and the use of any good text-books, and must be standard in its framework rather than in its details. It will of course be binding upon no one, and must make its way, if at all, by its merits; and it will be liable to minor changes in the future, based upon trial and scientific advances. Colleges would naturally first adopt it as an alternative to their own systems. Especially it should face squarely the issue of providing a course equal in training value to the other subjects, for by this test botany, and the other sciences, must be judged, and stand or fall in the educational system.

With full faith in the possibility of preparing such a course, I would ask the Society:

1. Does a standard or uniform college entrance option in botany seem desirable?

2. Does it seem possible of attainment?

If the answer to these questions is in the affirmative, I would propose:

a. That a committee of three be appointed by the president before the close of this meeting, with power to open communication in the name of the Society with colleges, examination boards and individual teachers upon this subject, and to take such steps as their judgment approves towards formulating and securing the adoption of such an entrance option.

b. That the committee make the attempt to secure an option nationally acceptable, but if this be found impracticable, then it

shall be attempted only for the region covered by the work of the College Entrance Examination Board of the Middle States and Maryland, and of the corresponding New England board if formed.

c. That the committee be authorized to draw upon the secretary-treasurer for its expenses of printing, etc., up to a limit of $20.00.

The Society voted to approve this plan with the proviso that the Committee should submit to the members by mail a preliminary printed report, and should be guided by any opinion submitted by a majority of the members. The president appointed Messrs. Ganong, Lloyd and Atkinson such a committee. The preliminary report of the committee is now ready, and will be sent to members of the Society and to others known to be interested. Others wishing to see the report may obtain copies by application to the writer. The appearance of the final report will be announced through SCIENCE.

W. F. GANONG.

SMITH COLLEGE, NORTHAMPTON, MASS.

THE MICHIGAN ACADEMY OF SCIENCE.

THE seventh annual meeting of the Michigan Academy of Science was held at the University of Michigan, Ann Arbor, March 28th, 29th, and 30th, under the presidency of Professor Chas. E. Barr, of Albion College.

The general session of Thursday afternoon, March 28th, was devoted to the geological and archeological surveys of the State. The Secretary read a paper by Mr. Harlan Smith, of the American Museum of Natural History, on 'An Archeological Survey of Michigan,' and Mr. Geo. W. Bates, president of the Detroit Archeological Society, presented a second paper by Mr. Smith, on 'The Antiquities of Michigan, Their Value and Impending Loss.' This paper described many of the archeological remains of Michigan, and urged that steps should be taken to preserve them. (At a later meeting the Academy endorsed a bill now before the Legislature, providing for an archeological survey of the State.)

Dr. A. C. Lane presented a paper (read by the Secretary) on 'Recent Work of the State Geological Survey,' and Mr. Frank Leverett, of the U. S. Geological Survey, gave an account of 'Glacial Investigations in Michigan.' These papers showed that the Government and State Surveys are cooperating, and supplementing each other's work in many respects. The State Survey is devoting itself chiefly, in the lower peninsula, to the study of marl, and to a correlation of the various coal seams; in the upper peninsula to a correlation and study of the copper-bearing lodes. Mr. Leverett's paper presented certain economic and scientific results of the U. S. Geological Survey, particularly in the mapping and interpretation of topographic features, and in variations in the structure of glacial deposits. The successive positions of the margin of the glacial ice were shown to be marked by moraines or massive belts of rolling country which are found to sweep around the basins of Lake Michigan, Saginaw Bay and Huron-Erie. These carry on their outer borders more or less extensive plains of gravel and sand, which were formed by the outflowing waters of the melting ice-sheet. The distribution of these moraines and bordering gravel plains indicates that the first counties of Michigan to be uncovered by the melting back of the ice are Branch, St. Joseph, Kalamazoo and Calhoun, and the water from the ice then flowed to the Kankakee River, past South Bend, Ind. The ice margin melted back from these counties toward the lake basins to the west and north and east, and after a time it shrunk within the present limits of the Great Lakes. The lake history connected with the present system of Great Lakes is very complicated and as yet but partially worked out.

The Academy then divided into sections of botany, zoology, sanitary science and agriculture, and sectional meetings were

held on Thursday afternoon and Friday forenoon, under the chairmanship of the sectional vice-presidents.

In the Botanical Section, Professor C. F. Wheeler, chairman, the following papers were read:

'The Perception Zone of Roots': DR. FREDERICK C. NEWCOMBE, Ann Arbor.

'Transition from Stem to Root in *Echinocystis lobata* Torr. & Gray': DR. JAMES B. POLLOCK, Ann Arbor.

'Zygomorphy of *Stylidium adnatum* R. Br.': GEORGE P. BURNS, Ann Arbor.

'Adaptation of *Solanum Dulcamara* L. to Aquatic Conditions': THERESA G. WILLIAMSON, Ann Arbor.

'Ecological Study of a Glacial Lake near Ann Arbor': HOWARD S. REED, Ann Arbor.

'Aerotropism of Roots': MAY ELLA BENNETT, Ann Arbor.

'A Disease of the White Birch': JOHN LARSEN, Ann Arbor.

'Conditions influencing the Vitality of Seeds': JOSEPH W. T. DUVEL, Ann Arbor.

'Interfoliar Scales of Monocotyledonous Aquatics': MINNA C. DENTON, Ann Arbor.

'Something concerning the Forests of Northern Michigan.' With lantern views: DR. W. J. BEAL, Agricultural College.

'Notes on the Flora of Eaton County': PROFESSOR HUBERT LYMAN CLARK, Olivet.

'The Dwarf Mistletoe in Northern Michigan': PROFESSOR CHARLES F. WHEELER, Agricultural College.

'The Relation of Algæ to Marl': PROFESSOR CHARLES A. DAVIS, Alma.

'A Noteworthy Occurrence of *Wolffia*': PROFESSOR CHARLES A. DAVIS, Alma.

'Notes on *Utricularia cornuta* Michx.': PROFESSOR CHARLES A. DAVIS, Alma.

'Notes on Michigan Saprophytic Fungi': B. O. LONGYEAR, Agricultural College.

'New Species of Michigan Fungi': B. O. LONGYEAR, Agricultural College.

'A Sclerotium Disease of the Huckleberry': B. O. LONGYEAR, Agricultural College.

'Causes inducing Asparagus to take its Form of Growth': L. LENORE CONOVER, Detroit.

In the Zoological Section, under the chairmanship of Mr. Bryant Walker, of Detroit, papers were given as follows:

'Phototaxis in Amphipods': DR. S. J. HOLMES, Ann Arbor.

'Preliminary Report on the Molluscan Fauna of the Region about Ann Arbor': MR. H. E. SARGENT, Detroit.

'Suggestions for a Method of Studying the Migrations of Birds': MR. L. J. COLE, Ann Arbor.

'The Occurrence of *Ammocœtes*, the Larval Form of *Lampetra wilderi*, near Ann Arbor': MR. D. C. SCHAFFNER.

'Some Aspects of the Electrotactic Reaction of Lower Organisms': MR. RAYMOND PEARL.

'A Curious Habit of the Slug, *Agriolimax*': MR. RAYMOND PEARL.

'The Effect of very Intense Light on Organisms': MR. RAYMOND PEARL and Mr. L. J. COLE.

'Certain Reactions of the Common Slug, *Agriolimax campestris*': MR. RAYMOND PEARL and MISS MAUDE M. DEWITT.

'Some Further Notes on the Breeding Habits of *Amia*': PROFESSOR JACOB REIGHARD.

'On the Anterior Head Cavity of the Elasmobranchs': PROFESSOR JACOB REIGHARD.

'On the Early History of the Auditory and Lateral Line Organs of *Amia*': CORA J. BECKWITH. Read by Jacob Reighard.

'The Classification of Birds': PROFESSOR HUBERT L. CLARK, Olivet.

'The Breeding Habits of Holothurians': PROFESSOR HUBERT L. CLARK, Olivet.

'Death from the Bite of the Water Moccasin, *Agkistrodon piscivorus*': PROFESSOR WALTER B. BARROWS, Agricultural College.

'Birds of the Carolinian or Upper Sonoran Zone in Michigan': PROFESSOR WALTER B. BARROWS, Agricultural College. Read by title.

In the Section of Sanitary Science, Hon. Frank Wells of Lansing, chairman, the following papers were read:

'A Bacteriological Study of an Epidemic among Guinea Pigs': LOUIS M. GELSTON, Ann Arbor.

'Frænkel's Pneumococcus found in a Case of Tonsilitis': W. G. CARHART, Ann Arbor.

'The Detection of Boric Acid in Milk': W. H. VEENBOER, Ann Arbor.

'The Detection of Formaldehyde in Milk': A. J. HOOD, Ann Arbor.

'The Toxin of the Colon Bacillus': DR. V. C. VAUGHAN, Ann Arbor.

'Some Results of Public Health Work': HON. FRANK WELLS, Lansing.

'Biological Problems in the Prevention of Certain Diseases': DR. HENRY B. BAKER, Lansing.

In the Section of Agriculture, J. A. Jeffery, chairman, Dr. W. J. Beal gave a

paper on 'Some Relations of Botany to Agriculture,' and Mr. Kenyon Butterfield gave a talk on 'Some New Phases of Agricultural Education.'

On Friday afternoon a joint session of the Academy and the Biological Section of the Michigan Schoolmasters' Club was held in the University Museum. This session was largely devoted to the pedagogical aspects of the biological sciences. The papers given were as follows:

'Nature Study.' Presidential Address: Professor Charles E. Barr, Albion.

'How Shall a Young Person Study Botany?' Dr. W. J. Beal, Agricultural College.

'Outline for a Year's Work in Botany': L. Lenore Conover, Central High School, Detroit.

'Suggestion for a Year in Zoology': Miss André, Central High School, Detroit.

'Value of Supplementary Experiments': Dr. Lewis Murbach, Central High School, Detroit.

'Science in the High School': Miss Palmer, High School, Lapeer.

'Recent Work and Theories on Fertilization of Animals': Dr. S. J. Holmes, Ann Arbor.

'Recent Work and Theories on Fertilization of Higher Plants.' Illustrated by Lantern Slides: Dr. J. B. Pollock, Ann Arbor.

'The Proposed Topographic Maps of Michigan': Dr. Israel C. Russell, Ann Arbor.

Two evening lectures were given before the Academy. On Thursday evening, Professor H. S. Carhart of the University of Michigan lectured on 'The Place of Physics in a Liberal Education,' and on Friday evening, Professor F. H. Herrick of Western Reserve University gave an illustrated lecture on 'The Haunts and Habits of Wild Birds.'

At the business meeting Saturday morning a committee was appointed to confer with corresponding committees from other scientific societies of the State, with a view to the affiliation of the other scientific bodies of the State with the Academy. The Academy voted also to endorse the bill now before the Legislature for an archeological survey of Michigan. The following officers were elected for the coming year:—

President, Professor Victor C. Vaughan, University of Michigan; *Vice-President*, for Botany, Professor C. F. Wheeler, of the Michigan Agricultural College; for Zoology, Professor Hubert Clark, of Olivet College; for Sanitary Science, Hon. Frank Wells, Lansing; for Agriculture, Professor J. A. Jeffery, of the Michigan Agricultural College; *Treasurer*, Professor Wm. H. Munson, Hillsale College; *Secretary*, Dr. James B. Pollock, University of Michigan.

A considerable number of new members were elected at this meeting; the sessions were well attended, and great interest was manifested in the work of the Academy. Altogether the meeting was the most successful and interesting in the history of the Academy.

H. S. Jennings.

SCIENTIFIC BOOKS.

Traité d'astronomie stellaire. Par Ch. André. Directeur de l'observatoire de Lyon. *Première partie: Etoiles simples.* 1899. Pp. xvi + 344. *Deuxième partie: Etoiles doubles et multiples. Amas stellaires.* Paris, Gauthier-Villars. 1900. Pp. xxiv + 429.

This excellent work seems to have attracted less attention than it deserves. It has the distinction of filling a gap in the literature of the subject. It covers ground which is common to both astrophysics and astronomy of position, as treatises are now more and more compelled to do; for in spite of the increase of specialization, the distinction in results obtained by astrophysical and astronomical methods is becoming slight. What, for instance, is an essential difference between the two components of the actual linear motion of a star, although the one is determined purely by the processes of astronomy of position, while the other is measured by the spectroscope?

The opening chapter of Professor André's first volume deals with objectives and mirrors, a topic upon which he is especially well fitted to speak. The sections treat of the theory of optical images, of the effect of diffraction screens or diaphragms over the objective, and of images

of the sun and planets. Chapter II. gives a general description of the constellations and a discussion of the various star catalogues and charts since the time of Hipparchus. The next two chapters deal with stellar magnitudes, referring particularly to determinations of brightness made without instrumental means. The number and distribution of the stars, and a study of the Milky Way occupy two chapters.

The proper motion of the sun and the various methods of determining the apex of the sun's way are next considered, and this is naturally followed by the proper motions of the stars. An especially interesting table is that giving a comparison of the radial velocities with the proper motions on a great circle for fifty of the brightest stars. Chapter IX. treats of stellar parallaxes, giving the results obtained by many investigators. The volume closes with a chapter of 50 pages on variable stars.

The orbits of binary systems and the various methods of their calculation (Herschel, Kowalsky and Glasenapp, Zwiers) are discussed at considerable length, together with their number and dimensions, in the opening chapters of the second volume. A table is given containing the elements of sixty-six known orbits. The effect of the introduction of a linear element, the radial velocity, is treated in one of the sections, and M. André has calculated for the sixty-six well-established binaries the epochs at which a maximum radial velocity may be expected, and the value of that maximum on the assumption of a stellar parallax of 0″.2. 'Astronomy of the Invisible' is the title of a chapter of 37 pages, dealing chiefly with the orbits of *Sirius*, *Procyon*, *ζ Cancri*, and 70 *Ophiuchi*.

The methods of Rambaut and Lehmann-Filhès for computing the orbits of spectroscopic binaries are given in sufficient detail in a separate chapter. About one hundred and thirty pages are next devoted to 'photometric binaries.' This includes a full historical account of *Algol* and its investigation by Pickering, Harting, Vogel, Chandler and Tisserand, together with all available data as to seventeen other variables of the Algol type. Dunér's beautiful work on the orbit of Y *Cygni*, published last spring in the *Astrophysical Journal*, was unfortunately too late to be included.

Subsequent chapters treat of the clusters and nebulæ, in particular of the *Pleiades*, *Præsepe*, and the region of *η Carinæ*; of the distribution of these objects, and of their distance. Globular clusters have a chapter of their own, which includes Bailey's recent remarkable variables. A short chapter is also given to colored stars.

The two volumes contain over one hundred cuts, and three excellent plates, and are printed in the usual excellent manner of Gauthier-Villars. A rather large list of errata is given, and probably more will be found. The book abounds in examples of the characteristic French disregard of the correct spelling and initials of foreign proper names.

This somewhat detailed account of the scope and contents of the work has been given to justify the remark that it fills a gap in the literature of the subject. The book would seem to be very well adapted for a basis of an elective course for seniors in our colleges, and the subjects treated are surely of greater freshness and interest, and of no less value in mental discipline, than the customary courses on the orbits of comets and planets.

A third volume is promised to complete the work—on the methods and instruments of modern research, and on the formation and evolution of the universe.

EDWIN B. FROST.

The Steam-engine Problem. By S. H. BARRACLEUGH, B.E. (Sydney), M.M.E. (Cornell). Russell School of Engineering, University of Sydney, N. S. W. Sydney, Kealy and Phillip. 8vo. 1900. Pp. 47. Figs. 13.

In this little book of less than fifty pages, Professor Barracleugh admirably outlines the problem of the steam-engine as it is now coming to be enunciated by scientific engineers and by thermodynamists who recognize the fact that the thermodynamics of the ideal may not constitute all, and that the real engine offers a complex problem which involves the most abstruse studies in physics, mechanics and energetics. This outline originally appeared in substance in the *Australian Technical Journal*. It was

written for students having an elementary knowledge of the subject.

The plan of the book includes a statement of the problem, its financial aspect, its mechanics, the scientific side and the practical side as well. The scope of the problem, choice of site, character of installation, type of engine and boiler, and their design, construction, erection and operation, are excellently stated, including the finance of the case. Finance is taken as the controlling factor, and the costs of steam-power are indicated and illustrated. Rankine's method of apportioning the engine to its work, as a financial proposition, is described, its fatal defect shown, and the later and corrected system of use of true 'curves of efficiency' is described. In designing, the method of Professor Barr of ascertaining the results of general experience in determining the factor of 'safety' is described and its results given.

A brief and well-arranged statement of the fundamental principles of thermodynamics is presented and an excellent outline of the scientific side of the problem is laid down. The great defect of the real engine, its internal waste of heat and steam, is well described, as are the results of later investigations to determine its amount and its laws of variation.

R. H. Thurston.

Catalogue of the Fossil Bryozoa in the Department of Geology, British Museum (Natural History). By J. W. Gregory. The Cretaceous Bryozoa, Volume I. London, Longmans & Co. 8vo. Pp. 457. 17 pl.

The long list of British Museum (Natural History) catalogues has received another welcome addition in the Catalogue of the Cretaceous Bryozoa, Volume I., by Dr. J. W. Gregory.

This catalogue is devoted entirely to descriptions and figures of the Cretaceous bryozoa, the groundwork, terminology, classification, etc., having been laid by the author in an earlier work of the same series: The Catalogue of the Jurassic Bryozoa in the British Museum (Natural History), published in 1896. In a second volume, to appear later, the author hopes to give a general introduction to the Cretaceous bryozoa, a list of localities with their horizons, and a bibliography. The catalogue is intended to be complete, to include every recorded species, though the large number of inadequate descriptions by early writers and their unrecognizable figures will leave much in doubt. It is a question whether science would not be a gainer if much of this early work could be authoritatively set aside. The desire to conform too strictly to the law of priority or to do justice to early workers sometimes results in even greater injustice to later workers.

The present volume treats only of the Cyclostomata. This division Dr. Gregory raises to ordinal value and divides into the suborders: Tubulata, with the families Diastoporidæ, Idmoniidæ, Entalophoridæ, Eleidæ; Cancellata, with families Horneridæ, Petaloporidæ; Dactylethrata, with families Clausidæ, Terebellariidæ, Reticuliporidæ.

The large size of the present volume is itself evidence of the fine collection which the British Museum has accumulated. The author notes the large additions recently made to the collection and laments that an American collection was received too late to be included in this volume. Doubtless the second volume will supply the deficiency. No work of importance has been done on bryozoa from secondary and tertiary formations of America since the work of Gabb and Horn in 1860–62. The interesting bryozoan fauna of the Cretaceous marls of New Jersey has begun, however, to attract the attention of workers in this country as well as abroad.

The greatest of the many merits of the volume under consideration is the great care taken in collecting full synonymy and in giving careful, accurate descriptions with measurements. The rather complicated mode of relative measurements which the author employed in the volume on the Jurassic bryozoa he has abandoned for the simpler and more easily comprehended plan of absolute measurements. We believe the author adopts the correct position when he says that dimensions, while important, seem to him of far less value than is attached to them by some continental writers, who make them the chief specific distinctions. It is no doubt true that, in some groups, each species is very constant in its dimensions, while in other groups species are very variable in this respect. But the same is true of other charac-

ters; a character which is constant and therefore reliable for purposes of differentiation and classification in one suborder or family, in another may be highly variable. This fact must be recognized in framing classifications.

The author retains with a few minor changes the classification proposed in the catalogue of the Jurassic bryozoa. In the present state of knowledge some scheme of classification is a necessity and yet but a temporary expedient. Our knowledge of the derivation, purpose, function and relative importance of the various structures found in fossil bryozoa is still too imperfect to enable an abiding classification to be framed. After all, the main purpose of a classification is to provide a scheme for maintaining an easy grasp upon relationships.

At the present time the best work that can be done is just the kind which our author does in this work, the giving of careful, close, accurate description with some account of the variations exhibited by a 'species,' with figures from which the form can be certainly recognized, and the careful, accurate, critical examination of the literature to weed out the synonyms. The author describes a considerable number of new species, showing that even in this direction there remains a great deal to be done. To the student of the bryozoa in general and the Cretaceous bryozoa in particular, the present volume must prove an indispensable working requisite.

J. M. N.

The Human Nature Club; An Introduction to the Study of Mental Life. By EDWARD THORNDIKE, Ph.D. Longmans, Green & Co. 1901. 8vo. Pp. 235.

This is an attempt to present the main facts of psychology in the form of a story, or at least of dialogue. Of this aspect of the essay the author says: 'Dramatically it is an atrocity.' Such frank disclaimer makes any further comment ungracious. And yet it would certainly have added much to the success of the undertaking not to have so entirely ignored the artistic factor in the presentation. It must, however, be viewed merely as a pedagogic aid to the popularization of the study of psychology, and particularly as a means of arousing interest in the significance of the every-day mental life among every day people. As such it is an eminently sound and helpful presentation. It is also more than this, as it presents a perspective of the importance of some of the factors of mental assimilation, which bear the mark of close and original thinking. This is particularly true of the discussion of the formation of habits, with reference to the effect of special upon general training. In the main it is an appropriately eclectic treatment of the primary elements of our mental nature. The Human Nature Club is a very artificial assemblage of persons, who discuss, with rare singleness of purpose, 'what the brain does,' and the 'things we do without learning' and 'the different ways of learning'; consider the senses and memory and attention and trains of thought and mental imagery and suggestion and imitation and our emotions and our actions and character, and some other yet more complex and deeper questions. Socrates would certainly be shocked at the modern speed with which conclusions are drawn from a few sporadic, and yet significant, illustrations, with but little allowance for analysis or dialectic. But this is inevitable, if the book is to cover its ground; and after all, the characters of the dialogue do not really draw these conclusions, but only restate them from such worthy authorities as James and others. The psychological matter is well grounded, suggestive, discriminatingly used and clearly set forth. The query will arise with reference to the proof of the pudding, which according to modern notions is not in the eating, but in the digestion thereof. That the book may prove palatable to certain palates, it is easy to believe; but whether persons with sufficient maturity of mind to consider psychological questions at all should not be at once placed on more strenuous diet, is a question upon which teachers of psychology are likely to hold diverse opinions. Yet with whatever training they may desire their pupils to approach the study of mental phenomena, it would be mere perversity to fail to recognize that there is in this country a large class of persons who do 'study' psychology, are genuinely interested, and are likely to be approachable only by ap-

propriate popularizations. For these this volume has the promise of proving serviceable, and to others and more serious students it may not be without suggestive value. It is fortunate, at all events, that the psychology thus presented draws its inspiration from worthy and scholarly sources, and is presented in a way calculated to make the student think and observe, not merely read and repeat. We may question whether good wine should be so much diluted; but however thin, it retains a flavor which wine of lesser quality never bears.

J. J.

BOOKS RECEIVED.

Report of the Seventieth Meeting of the British Association for the Advancement of Science, held at Bradford, in September, 1900. London, John Murray. 1900. Pp. cxvi + 975 + 111.

Report of the U. S. National Museum. Part II. *A Memorial of George Brown Goode together with a selection of his Papers on Museums and on the History of Science in America.* Washington, Government Printing Office. 1901. Pp. xii + 515.

The Elementary Principles of Chemistry, accompanied by Suggestions to Teachers. A. W. E. Young. New York, D. Appleton & Company. 1901. Pp. xiv + 106 + 48.

Ganot's Natural Philosophy. Translated by E. Atkinson and revised by A. W. Reinold. Longmans, Green & Co. 1900. Pp. xii + 752.

Lepeophtheirus and Lernæa. No. VI. of the Liverpool Marine Biological Committee Memoirs. Andrew Scott. London, Williams & Norgate. 1901. Pp. viii + 54 and 5 plates. 2 s.

Second Report of the United States Board on Geographic Names, 1890–1899. Washington, Government Printing Office. 1901. Pp. 150.

SCIENTIFIC JOURNALS AND ARTICLES.

Number LI. of the *Journal of American Folk-lore*, which is late in appearing, and concludes the year 1900, contains as the first article a Hawaiian legend entitled 'Laieikawai,' from the memoranda of Dr. John Rae, by whom the story was taken down and translated, probably about 1860. Of this narrative a variant appears in the book of King Kalakaua, published in 1888. Both versions are abstracts, but the account of Rae, which is only a fragment, is so far as it goes much fuller, and gives a much better idea of the literary character of Hawaiian myth than any other accessible source of information. The story seems to have been a prose epic narration of great length, ornamented with occasional pieces of verse and provided with a very complicated plot. The state of society, and the conceptions as well as modes of expression, frequently remind the reader of the Homeric poems. The heroine from whom the tale is named was worshipped by certain Hawaiian gentes under the title of the Lady of the Twilight, and the sun-hero became her husband. The story of Rae recites the manner in which the girl, as born before the coming of a brother, is sentenced to be put to death, her concealment by her grandmother, education in a cave below a waterfall, growth to maturity, and great beauty, the fame of which got abroad, and caused a quest after her place of hiding, which was indicated by the presence of a rainbow, attendant on the maiden as of divine race. The narration is full of information concerning Hawaiian cult and superstition, and makes a valuable addition to the existing stock of knowledge. It is to be hoped that the publication may lead to a determined attempt to preserve Hawaiian legendary lore, and to procure full and correct texts in the original language. Miss A. C. Fletcher describes a Pawnee ceremony of thanksgiving, at which she had the good fortune to be present. In this rite a buffalo skull was worshipped as representative of an ancient divine buffalo established by the supreme deity Tirawa as mediator and teacher of men. Dr. A. F. Chamberlain contributes a discussion on 'Algonkian Terms connected with Religion and Mythology.' Among the items of belief may be noted evidence that sacrifices were made to the war-god by the suspension to trees of human victims; one is reminded of the similar Norse offerings to Odin. Rev. W. M. Beauchamp supplies an Onondaga tale of the Pleiades, in which these stars are represented as merry children who have danced themselves into the sky. The excellent record of 'American Folk-Lore' is continued by Dr. A. F. Chamberlain (Clark University, Worcester, Mass.). With the present year Dr. Chamberlain will assume the general management of the journal, Mr. W. W. Newell, who has hitherto

fulfilled that function, remaining as associate editor.

In a reprint of articles on early American ballads, contained in Nos. 47 and 49 of the same *Journal*, Mr. W. W. Newell traces the history of certain ballads produced in Massachusetts. One of these, called 'Isaac Orcutt,' and belonging to the end of the eighteenth century, recited the manner in which that youth met his death from a falling tree; the piece was sung as a dirge at the funeral, being chanted by six young women dressed in white. Similar was the origin of 'Springfield Mountain,' produced in 1761, in memory of the son of a Lieutenant Merrick, of Wilbraham. The ballad attained extraordinary popularity in the United States, being sung with numerous variations; it abdicated its local character, took on a love situation, and survives as a comic song. These examples are the more curious inasmuch as the custom of chanting dirges over the dead seems not to be recorded in English folk-lore.

The Popular Science Monthly for April opens with a sketch of the work of 'Malpighi, Swammerdam, and Leeuwenhoek,' by William A. Locy. Paul H. Hanus discusses 'Two Contemporary Problems in Education,' What shall we do about the elective system of studies and how shall we bridge the gap between the high school and the lower grade? Incidentally Professor Hanus advocates studying some modern language for two or three years before commencing Latin. Havelock Ellis continues 'A Study of British Genius,' this instalment being devoted to heredity and parentage, and the favorite topic of 'Suicide and the Weather,' is treated in some detail by Edwin G. Dexter. Charles H. Cochrane gives a résumé of 'Recent Progress in Aërial Navigation,' and 'The Foreign Trade of the United States,' is treated at some length by Frederic Emory, who, while noting its recent great increase, calls attention to the fact that in the near future we may be obliged to struggle to retain it. Finally Solon I. Bailey tells of 'The Planet Eros,' which for various reasons, among them its importance for determining the solar parallax, is for the moment of more interest to the astronomical world than the greatest planet. The various departments contain articles of interest and the number contains the index for Vol. LVIII.

SOCIETIES AND ACADEMIES.

SECTION OF BIOLOGY OF THE NEW YORK ACADEMY OF SCIENCES.

AT a regular meeting of the section held on March 11, 1901, the following program was offered:

H. F. Osborn: 'Systematic Revision of the American Eocene Primates and of the Rodent Family *Mixodectidæ*.'

O. P. Hay: 'The Composition of the Shell of Turtles.'

M. A. Bigelow: 'Some Comparisons of the Germ-Layers in Entomostraca Crustacea.'

Professor Osborn stated that the only fossil primates at present known are those in the Eocene. The supposed Oligocene genera described by Marsh and Cope have proved to belong to the Artiodactyla. Associated throughout with the discovery and literature of the primates is the family Mixodectidæ, including *Mixodectes* of the basal Eocene or Torrejon beds; Mathews has suggested that this animal is a rodent. Careful comparison of this type with the supposed primates *Cynodontomys* of the middle Eocene and *Microcyops* of the upper Eocene proves that these animals also belong probably with the rodentia; they represent a primitive stock with strong affinities to the Tillodontia, which are thus brought nearer to the ancestral rodents. This conclusion removes all these animals from the primates where they have hitherto been placed. This leaves three families of monkeys, as follows: Hypsodontidæ, including *Hypsodus* and *Sarcolemur*, animals of medium size, retaining the typical series of 44 teeth; a second family, the Notharctidæ, including *Pelycodus* and *Notharctus*, animals of larger size, with teeth reduced to 40 by the loss of 4 incisors, and like the foregoing comprising long-jawed types; and a third family, the famous Anaptomorphidæ of Cope, short-jawed, very progressive types, with 36 to 32 teeth, the premolar series being reduced. The identification of these families with the Eocene *Adapidis* or with *Necrolemur* of Europe is not sustained. The Hypsodontidæ and Notharctidæ are well

distinguished by sexituberculate superior molars.

Dr. Hay called attention to the fact that for a long time there has been much discussion regarding the origin of the elements entering into the shell of turtles. As to the bones known as costal plates, the great majority of anatomists have held that they have resulted from the union of dermal bones with underlying ribs: the neural plates from the union of dermal bones with the neural arches. Recently Goette has studied the development of the costals and neurals in the young of *Chelone squamata*. He finds that the whole costal plate develops continuously from bone which appears beneath the perichondrium of the cartilaginous ribs. No part of either the costal or neural plates arises in the skin. While accepting Goette's results as established, the speaker did not accept his conclusion. Neither did he accept the other view that the costals and neurals are composed of dermal bones united with those of the internal skeleton. The speaker held that there were originally three strata of bones on the dorsal surface of turtles. One of these was in the skin, and is represented by the mosaic found in the skin of *Dermochelys*. Another layer was sub-dermal, and this united with elements of the third stratum, namely the ribs and neural arches. This union has become so complete that the bones arise from the same centers. These three strata of bones on the dorsal surface correspond to those which are found in the ventral wall of the caiman, viz: true ribs, 'abdominal ribs,' and bony dermal scutes.

Mr. Bigelow compared the germ-layers of various Crustacea with special reference to the Cirriped *Lepas*. It was pointed out that in the cleavage leading to the segregation of the germ-layers there are very many resemblances between *Lepas* and other Entomostraca. *Lepas* resembles most other Crustacea in respect to the position of the blastopore, and the extension of the entoblast and mesoblast from that region as a starting point. In *Lepas* also the mesoblast and entoblast originate from cells which, speaking in general terms, lie at first in the blastoderm and later migrate into the cleavage cavity. But among these immigrating mesentoblastic cells one can distinguish the individual cells of entoblast and two varieties of mesoblast, entomesoblast and ectomesoblast. There are observations indicating that similar conditions exist in other Crustacea.

Henry E. Crampton,
Secretary.

Section of Astronomy, Physics and Chemistry of the New York Academy of Sciences.

A regular meeting of the section was held on April 1, 1901. The first paper was by Mr. H. C. Parker, on some 'Experiments on Standards of High Electrical Resistances.' The author briefly described the usual methods employed in the measurement of high resistances and then gave an outline of Professor Rood's electrometer method (*American Journal of Sciences*, Vol. X., October, 1900, pp. 285–294). By this method it seems possible to measure resistances as great as 1,000,000,000 megohms, while by the direct deflection method the practical limit was stated to be about 100,000 megohms.

The author gave the results of a series of measurements made on a new form of standard high resistance, devised by Professor Rood. This form of standard consists of oxide of manganese on cobalt glass. It gives a convenient means for obtaining resistances of from one to ten thousand megohms. Most of the measurements were for the purpose of determining the best protective insulating material with which to coat the above resistances. The author stated that the work was still in progress.

Professor J. K. Rees then presented a paper on 'Temporary Stars, with Especial Reference to the New Star in Perseus.' Professor Rees explained the present classification of variable stars and gave illustrations of each of the six classes. A history of the discovery of the new star in Perseus was given and photographs of its spectrum were exhibited. Brief mention was made of the various collision theories proposed to account for the evidence of two light sources which appear involved. The light curve of the new star was referred to, showing how rapidly the star increased to the 0 magnitude,

from which it has slowly decreased to, at present (April 1st), the 5th magnitude.

The paper was discussed by Professors Hallock and Herring, Dr. Day, Mr. C. A. Post and others.

Professor Rees then gave 'An Exhibition of some of the Photographs of Nebulæ taken with the Crossley Reflector of the Lick Observatory,' by the late director, J. E. Keeler. Professor Rees remarked that Columbia University had lately received a series of beautiful photographs of nebulæ from the director of the Lick Observatory. After a brief description of the Crossley reflector, and of the remarkably successful work of Dr. J. E. Keeler in the photographic study of nebulæ, the illustrations named below were thrown upon the screen.

Orion nebula, taken November 16, 1898; exposure, forty minutes.

51, M. Canum Venaticorum, taken May 10, 1899.

Dumbbell nebula in Vulpecula, taken July 31st, 1899; exposure, 3 hours.

Trifid nebula in Sagittarius; exposure, 3 hours.

The Pleiades, showing nebulosity.

Ring nebula in the Lyra.

Crab nebula in Taurus.

Small nebula in Andromeda.

Spiral nebula M. 74, in Pisces.

Spiral nebula in Pegasus.

Spiral nebula in Triangulum.

Spiral nebula in Ursa Major.

Net work nebula in Cygnus.

M. 13, in Herculis, star cluster.

Reference was made to Keeler's determination of radial velocities of nebulæ and to the distances of these masses. In conclusion an enthusiastic tribute was paid to the late Director Keeler.

F. L. TUFTS,
Secretary.

THE ONONDAGA ACADEMY OF SCIENCE.

At the regular monthly meeting held at the Medical College, Syracuse, N. Y., on February 15th, Dr. L. M. Underwood, of Columbia University, New York, addressed the Academy on the subject of 'Botanical Gardens.' His paper was a history of the great Botanical Gardens at Kew, Java, Berlin, etc, together with a description of the Gardens planned for New York in connection with the University. The address was very fully illustrated with a fine collection of slides.

The following officers were chosen for the ensuing year: *President*, Dr. W. M. Beauchamp; *Vice-President*, Dr. C. W. Hargitt; *Corresponding Secretary*, Philip F. Schneider; *Recording Secretary*, Horace W. Britcher; *Treasurer*, Miss L. W. Roberts; *Librarian*, Mrs. L. L. Goodrich.

On March 15th, the meeting was held at the Historical Rooms. The program consisted of the reports of the officers and sections for the year.

Mr. C. E. Wheelock read the report of the Geologic Section giving a detailed account of the various meetings and conferences. Two new cephalopods, undescribed as yet, were reported from the Goniatite Limestone, making seventeen organisms discovered in this formation.

Mrs. L. L. Goodrich read the report of the Botanical Section. Monthly meetings and weekly classes are held. At one of these meetings on the grounds of the Hon. C. E. Smith, Syracuse, a hybrid chestnut tree, which he had raised, was seen, upon which over a hundred humming birds had congregated to gather honey, a truly remarkable sight. Three new plants, one a fern, have been added to the list from this county. The ferns now number 41.

Dr. C. W. Hargitt gave the report of the Zoological Section. During the past year they have been working largely upon the lower forms, especially the bacteria, of local streams. Variations in local shells have also been recorded. Three new batrachians and 25 spiders have been added to lists from the county, and cyclops and branchippus described and identified.

The annual report of Secretary E. M. Patte^{e} showed 40 active, 17 associate and 3 corresponding members. It also recorded the loss by death of Professor J. A. Dakin, the noted ornithologist, during the year. Miss L. W. Roberts, treasurer, reported a balance of $87. Dr. Wm. M. Beauchamp, president-elect, then read his inaugural address. It was a clear and scholarly address, carefully defining his posi-

tion, and teeming with helpful suggestions and plans for the year.

PHILIP F. SCHNEIDER,
Corresponding Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of March 18, 1901, forty-three persons present, Professor E. H. Keiser delivered an address showing the progress made in the science of chemistry during the nineteenth century. This address will be published in a subsequent number of SCIENCE.

Professor F. E. Nipher exhibited pieces of pine board a foot square, showing the tracks of ball lightning discharges upon them like those formerly described by him in No. 6, Volume X., of the *Transactions* of the Academy. The discharges formerly described had been formed on a photographic film. The balls were very small, and wandered over the plate, leaving a track of metallic silver in their wake. In the present instance the balls were much larger, and they burned a deep channel in the wood. They are formed at the secondary spark gap of a coil. The terminals are pointed and are under control, so that the gap may be changed in length. To start the balls, the pointed terminals are put upon the wood surface, so near that the spark carbonizes somewhat, after which the gap is made longer. These balls travel in either direction, when a direct current is used, with a Wehnelt interrupter. This differs from the results reached on the photographic film with the Holtz machine. There the balls came from the cathode. Even when they originated at isolated points on the film, they traveled away from the cathode.

In the present results, the balls have been caused to originate at isolated points, and two balls have started in opposite directions. Wood which gives little flame shows the phenomenon to best advantage, but the balls preserve their identity and travel slowly along even when completely surrounded by flames of the burning wood.

Three persons were elected to active membership in the Academy.

WILLIAM TRELEASE,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

RESIGNATIONS FROM THE SCHOOL OF PEDAGOGY, NEW YORK UNIVERSITY.

OWING to long-continued dissatisfaction with the administration of the Department, the following professors of the faculty of the School of Pedagogy of New York University announce their resignation from the University:

SAMUEL WEIR,
Professor of History of Education and Ethics.
EDWARD F. BUCHNER,
Professor of Analytical Psychology, and Secretary of the Faculty.
CHARLES H. JUDD,
Professor of Experimental Psychology.

THE PROPER NAME OF THE ALPINE CHOUGH.

TO THE EDITOR OF SCIENCE: I should like to state the reasons why I cannot agree with Mr. W. J. Fox's proposal made in SCIENCE for February 8 (N. S., Vol. XIII., p. 232) to adopt the name '*Monedula pyrrhocorax*' for the Alpine chough. In the first place, as Mr. Fox allows, Hasselquist's '*Iter Palastium*,' being dated 1757, has no claim to recognition, even by those who take Linnæus's tenth edition (1758) as the commencement of zoological nomenclature. It seems to me, therefore, that the mere republication of his names in a German translation of that work in 1762 is not sufficient to give them validity. But what is still more important is that, as Mr. Fox will find, I think, on reading the original description carefully, it is by no means certain that Hasselquist's *Monedula pyrrhocorax* was based on a specimen of the Alpine chough, though it was referred to that species by Linnæus in his edition of 1758. Hasselquist gives 'Lower Egypt' as the place where his *Monedula pyrrhocorax* was discovered, but, according to the best authorities (see Schelley's 'Birds of Egypt,' p. 161), no such bird as the Alpine chough is known in Egypt, and it is indeed a very unlikely species to occur there, though it is found in the high rocky mountains of Algeria. Under these circumstances I maintain that we should not be justified in changing the familiar name *Pyrrhocorax alpinus* to *Monedula pyrrhocorax*.

P. S. SCLATER.

3 HANOVER SQUARE, LONDON, W.,
March 15, 1901.

NOTES ON INORGANIC CHEMISTRY.

ATOMIC WEIGHT STANDARD.

IN spite of the all but unanimous decision of the International Committee on Atomic Weights, that the standard should be Oxygen = 16, the question seems not yet to have been finally settled. At the December meeting of the American Chemical Society, a report was presented by the section of the International Committee appointed by the Society, in which it is shown that opinion is still somewhat divided, and an expression of views is called for from the members of the Society. For the guidance of the members a very fair statement is made in brief of the principal arguments for both standards. According to the report, Professor Erdmann writes that out of 143 replies to the teachers' circular, 118 favor the retention of the old standard, Hydrogen = 1. It will be remembered that after the report of the International Committee, six German chemists sent out a circular to the teachers of chemistry in German universities and technical schools, advocating the old standard, and calling for expressions of opinion. It is natural that replies to this *ex parte* circular should have been chiefly received from those who agreed with its views, but the number of favorable replies indicates that there is an element, by no means small, who are opposed to the majority. It is, however, not the teachers alone who are to be considered in this matter; the selection of the standard of atomic weights is of at least as much importance to the practical chemists, who vastly outnumber the teachers.

IN the opening number of the *Berichte* for the year, the section of the International Committee representing the German Chemical Society publish the annual table, headed 'Internationale Atomgewichte. O = 16.00,' but they also print a second table with the heading 'Didaktische Atomgewichte. H = 1.00,' with the comment that it is done for those teachers who cannot reconcile their teaching to a standard which is anything other than unity. It is interesting to note that in this table appear for the first time gadolinium, krypton, neon, thulium and xenon, which are thus given a final standing as elements.

In reviewing these tables in the *Zeitschrift für anorganische Chemie*, F. W. Küster reproduces the report in full, except that he omits the second didactic table, as unnecessary for the readers of the *Zeitschrift*. He says the only end gained by printing it would be to keep up the discussion, which should now be looked upon as finally settled. On the other hand, it would seem that in the end unanimity is far more likely to be obtained by still allowing the freest discussion, rather than by suppressing it, while any considerable number of chemists, including some of the most eminent, refuse to acquiesce in the decision.

ACTION OF ALCOHOL UPON METALS.

SOME time since, a note was made in these columns of a specimen of alcohol contaminated with zinc, which could only have come from its being kept, as is so often the case, in a galvanized iron container. The subject has been more recently investigated by Dr. Malméjac, and his results published in the *Journal de Pharmacie et de Chimie*. In his experiments he used ninety-five-per-cent. alcohol which left no residue on evaporation. The metals, copper, iron, tin, lead, zinc and galvanized iron, were corked up with the alcohol in glass flasks, and kept at ordinary temperature for six months. The copper was entirely unacted upon, but in all the other flasks there was a deposit at the bottom, and the metal was covered with a similar deposit. In the case of tin, lead, zinc and galvanized iron, the deposit was white; that from the iron was red, resembling iron rust. All the liquids, except that in which the lead had been placed, filtered clear; the latter retained its milky appearance after repeated filterings through double filters. The clear filtrates from iron, lead, zinc and galvanized iron gave much residue on evaporation, while the residue from tin was hardly appreciable. In the former cases it is clear that not only had the metal been oxidized, but a considerable quantity had entered into solution. These experiments have an important bearing on the preserving and shipping of alcohol, especially in view of the fact that absolute alcohol is very generally purchased in galvanized iron cans. In such a case redistillation is imperative.

J. L. H.

CURRENT NOTES ON PHYSIOGRAPHY.

THE ILLINOIS GLACIAL LOBE.

THE elaborate monograph by Leverett on 'The Illinois Glacial Lobe'(Monogr. XXXVIII., U. S. Geol. Surv., 1899, xxi + 817 p., 18 maps, 6 pl. 9 figs.) has, apart from its high worth as the most detailed study of its kind yet published, a great value to the physiographer in warranting a generic treatment of the class of forms that it describes. It is not merely that one may find, in this or that part of Illinois, till plains, moraines, loess beds, gravel trains and the like, but that these several parts have a form and distribution characteristic of their class. Since Chamberlin's recognition of the lobate margin of the glacial sheet indicated by the peculiar arrangement of its terminal moraines, evidence in great variety and quantity has been discovered to confirm his generalization ; and we have now come to possess good ground for regarding the moraines and the associated deposits and erosion forms of lobate ice sheets as characteristic elements of our topography, on a large scale horizontally, although of small vertical relief. The type form is relatively simple ; it consists of many parts, but they are systematically and genetically related in a highly specialized unit ; a unit whose empirical description is as baffling as would be the mention of an oak tree in terms of its items in arbitrary order instead of by its generic or specific name, but whose explanatory description is as easily apprehended as is that of a mature river-and-valley system. The association of several units by repetition of process provides something of the variety of nature ; special features due to local conditions require an elastic instead of a rigid conception of the type ; and the detection of the changes suffered by the initial forms with the passage of time affords a pleasing exercise for observation and understanding. An abstract of the facts thus understood, with Illinois as the field of their typical occurrence, should enter the high schools of this generation. Room may possibly be provided for them (by the exclusion of less worthy matter) in the grammar schools of the next generation. A closer study of the facts affords good exercise for collegiate students who have previously learned an outline of them in school. The details yet to be discovered in the field will tax the patience and ingenuity of the investigator for years to come. The monograph is a worthy monument to the skill of the observer who executed it, to the insight of the leader who planned it, and to the broad policy of the organization that supported its preparation and publication.

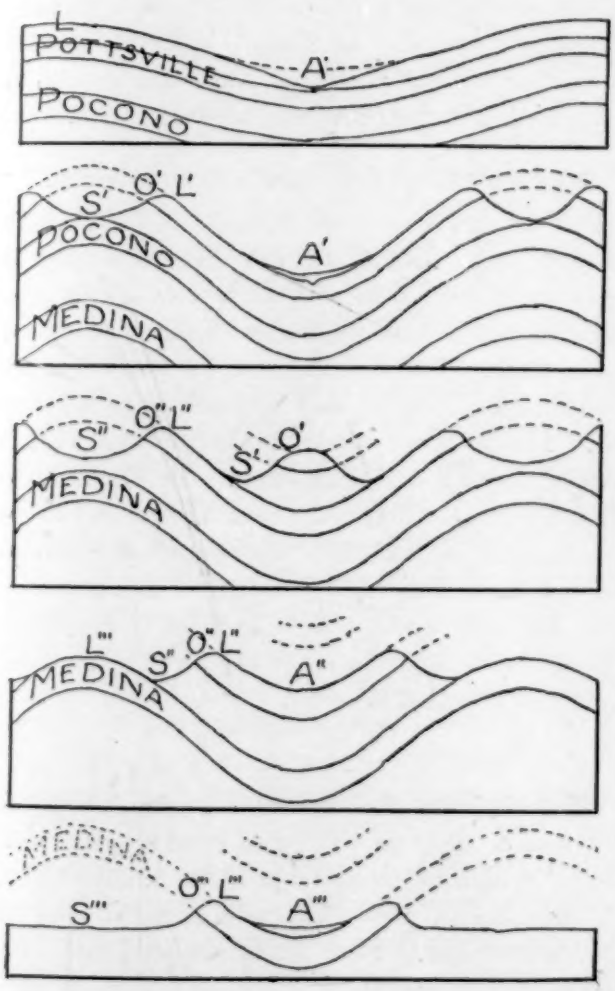
THE ALBAN MOUNTAINS.

THE group of extinct volcanoes southeast of Rome, sometimes known as the Alban mountains among English writers, but called *Vulcano Laziale* by the Italians, is elaborately described by Sabatini (Mem. descr. Carta geol. ital. X, I Vulcani del l'Italia centrale e i loro prodotti. Parte I., Vulcano Laziale. Roma, 1900, pp. xv + 392, 9 pl., 2 maps). The mountain group is the complex product of successive constructive and destructive actions. A large volcano of about 20 kil. diameter lost its upper portion and then remained as a horseshoe mountain (caldera) now somewhat dissected and open to the southwest. Its central floor had an altitude of 400 or 500 met., and its rim, of 600 to 800 met. This structure is called *Cratere Tuscolano.* A second volcano, called Monte Albano or Laziale, was built on the same axis as the first ; its basal diameter being 4.5 or 5 kil., and its altitude 956 met. It has a crater 200 met. deep, open to the northwest. At a still later time, three more or less complex basins or calderas were formed on the south and southwest of the central axis; they now contain lakes Nemi and Albano, of which some admirable views are given, and the plain of Ariccia. Lavas seem to constitute only a small portion of the volcanic mass. Its chief constituent is tufa, which Sabatini explains as successive deposits of volcanic ashes washed by rains, disregarding their suggested origin in torrents of mud ejected from the craters. Engulfment is not accepted as a satisfactory explanation either of the great *Cratere Tuscolano* or of the lake basins, but the argument for the exclusion of this process does not seem demonstrative. The volume of ejected materials is estimated to be about 200 cubic kilometers. More than half of the memoir is given to local and petrographic details. A bibliography occupies 22 pages. The colored geo-

logical map might well serve as a guide to the observant traveler in this most picturesque district.

REVERSION IN RIVER DEVELOPMENT.

IN the Seven-mountain district of Pennsylvania, the anticlines and synclines of the corrugated Medina sandstone, pitching gently eastward, form an extraordinary series of zigzag ridges. Streams rise in the apex of the synclinical reentrants and flow eastward with the pitch of each synclinical axis toward the Susquehanna; and these axial streams receive branches that descend the dip-slope of the linear monoclinal



ridges which diverge from each synclinal apex. Such a scheme of drainage has usually been called consequent; yet when it is remembered that the present relief has been developed by the removal of a great series of strong and weak strata it appears that the existing streams are not the persistent successors of the original consequents, but that they have reverted to ancestral conditions after having passed through a systematic series of metamorphoses, as indicated in the accompanying diagrams. The first section represents initial conditions. An original consequent stream (A') flows along the pitch of a synclinical axis of Pottsville conglomerate and is fed by lateral consequents ($L'A'$) from the slopes of the enclosing anticlines. Section 2 represents a later time when longitudinal subsequents have been developed along the anticlinal axes of the weak Mauch Chunk shales, thus shortening the laterals of the original system ($L'A'$) by favoring the growth of obsequents ($O'S'$). In section 3 the new subsequents have shifted down the dip of their determining formation, thereby developing a new lot of apparently consequent laterals ($L''S'$), and the initial trough has been reversed into a narrow synclinal ridge, crowned by a remnant of Pottsville conglomerate. The original axial consequent (A') has vanished and an anticlinal subsequent of the second order (S'') has appeared. With still further erosion, as permitted by successive uplifts, the two first-order longitudinal subsequents (S', sect. 3) coalesce by continued monoclinal shifting, and thus form a new axial stream (A'', sect. 4) with appropriate laterals ($L''A''$) in the trough of the Pocono syncline. By yet another series of analogous changes ending in the fifth section, a third-order axial stream will be developed (A''') fed by a series of third-order laterals ($L'''A'''$) on the Medina syncline, such as at present exist. Although these streams closely imitate the ancestral consequents of the first section ($A', L'A'$), it is evident that the imitation is due to reversion and not to the persistence of a fixed type. Streams of this kind might be called reversional consequents, renewed consequents, reconsequents, or simply resequents.

W. M. DAVIS.

CURRENT NOTES ON METEOROLOGY.

QUARTERLY JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY.

THE January *Quarterly Journal of the Royal Meteorological Society* contains several articles of general interest. Dr. Nils Ekholm contributes a paper 'On the Variations of the Climate of the Geological and Historical Past and their

Causes,' which was presented at the recent Jubilee meeting of the Society. The subject is treated at considerable length under the following heads: (1) The general causes of changes of temperature. (2) Geological chronology. The probable age of the earth. (3) The radiation of the sun nearly constant during geological ages. The temperature of the earth's surface explained by the equilibrium between insolation and radiation from the earth into space. (4) Variations in the quantity of carbonic acid of the atmosphere the principal cause of the great climatic variations during geological ages. (5) The secular cooling of the earth is the principal cause of the variations of the quantity of carbonic acid in the atmosphere. Modifying influences. (6) Variations of the obliquity of the ecliptic and their influence on the climate. (7) Climatic variations during historical times, particularly in northwestern Europe. Conclusions. Probable variations of climate in the future. R. H. Curtis considers 'An Improved Mounting for the Lens and Bowl of the Campbell-Stokes Sunshine Recorder,' by means of which the glass ball can be quickly and accurately placed centrally in the bowl, where it is secured by clamping screws. W. H. Dines contributes a paper on the 'Weekly Death Rate and Temperature Curves, 1890–1899,' which contains diagrams showing the death rate of the thirty-three great towns of England, and also curves of the temperature at Greenwich. The author is of opinion that from the health point of view the English climate is one of the best in the world. A pleasanter climate may easily be found, but the majority of health resorts to which Englishmen go in the winter have a higher death rate than London has at the same season, and a far higher rate than any of the country districts of the British Isles. A paper by H. Mellish discusses 'The Seasonal Rainfall of the British Isles.' The rainfall returns from 210 stations are analyzed for the twenty-five years, 1866–1890, and the percentage of the mean annual rainfall for each season is determined.

THE OLD YUMA TRAIL.

A STRIKING account of the history of 'The Old Yuma Trail' is given by McGee in the *National Geographic Magazine* for March. The part played by the arid climate of the region is touched upon here and there, and the terrible loss of life along the Trail during the 'gold-fever renaissance' is thus described: "Many of the travelers were fresh from humid lands, knew naught of the deceptive mirage or the ever-hovering thirst-craze of the desert, and pressed out on the sand wastes without needful preparation. The roll will never be written in full, since most of the unfortunates left no records, scores leaving no sign save some bleaching bones; but observers estimate that there were 400 victims of thirst between Altar and Yuma within eight years, an estimate which so conservative a traveler as Capt. Gaillard thought fair, after he had 'counted sixty-five graves in a single day's ride of a little over 30 miles.'"

HANN'S LEHRBUCH DER METEOROLOGIE.

PUBLIC announcement is made of Dr. Hann's forthcoming 'Lehrbuch der Meteorologie,' a book upon which, as was known to his friends, the eminent meteorologist has been at work for some time. The volume is to be published by Tauchnitz, of Leipzig, and may now be subscribed for. It is to come out in eight successive instalments, costing 3 Marks each. Dr. Hann is so well known to scientific men the world over, through his admirable 'Handbuch der Klimatologie' and his many other shorter publications, that his new book, which is already assured a hearty welcome and a large sale, will be awaited with the greatest interest.

NOTES.

THE *National Geographic Magazine* for March contains a paper on 'The Sea Fogs of San Francisco,' which is an abstract of an article by A. G. McAdie in the *Monthly Weather Review* for last November. Five excellent half-tones accompany the paper.

THE *Bulletin of the American Geographical Society*, No. I., 1901, pp. 42–46, contains a paper by W. H. Alexander, Observer of the Weather Bureau, on 'St. Christopher, West Indies,' in which there are some statements concerning the climate.

THE full discussion of 'The Eclipse Cyclone and the Diurnal Cyclone,' by H. H. Clayton,

to which reference was made in these notes in SCIENCE for March 1, has appeared in Part I., Vol. XLIII., of the Annals of the Harvard College Observatory (pp. 33, pls. IV.).

R. DEC. WARD.

SCIENCE AND INDUSTRIAL COMPETITION.

Two small but very significant publications, recently issued from the press, will interest every intelligent citizen, and should particularly interest the man of science, the practitioner in applied science and, perhaps most of all, the always rare but always influential statesman.* The one is a reprint of letters to the London *Times*, the 'Thunderer,' from an able and distinguished Briti.. engineer traveling in the United States and reporting to that paper upon the aspects of 'American Engineering Competition'; the other is a series of addresses and magazine articles by Professor John Perry, the able and original electrician and engineer, upon methods of teaching the sciences. There is possibly an important connection between the two seemingly diverse subjects.

The one describes the latest and best, as well as the most important, of American methods and apparatus of industrial production. The universal adoption of scientific methods; the extensive employment of the product of inventive genius; the utilization of applied science in any and every possible way in the promotion of the arts; the adoption of scientific methods of organization, of administration and of maintenance of the great systems of industry, of production, transportation and distribution; the universal faith in and practice of systematic and scientific processes of ore-production and transportation, of trans-shipment, of reduction; the manufacture of iron and steel, 'manufacturing,' all articles made of iron or steel rather than simply 'making' in older way; the part taken by automatic machines in the rapid transformation of the older into the newer system, with resulting increase of product per man, and of wages, and yet with decreasing costs and prices: all these elements of industrial progress are discussed. The other sharply arraigns the English educator for his utter neglect of the applied sciences and for his indifference to their utilization in the life and work of the English people, and attributes the later relative retrograde movement of Great Britain in part, at least, to this neglect of science and to the greater activity and the statesmanlike policies and methods of education of Germany and the United States.

The one traces in a most admirably complete, yet condensed and succinct, way the great movements in the fundamental industries of the United States during the past decades and up to its recent astounding development of a foreign trade. It closes a most intensely interesting and instructive and suggestive discussion by two chapters on the labor question, which this author seems to think a much more important element in the relative decadence of Great Britain as a manufacturing nation than even that neglect of science which has awakened Professor Perry's most serious apprehensions. In the other book, that distinguished electrician criticises, not the science-teacher so much, nor even the leaders in the industrial systems of his country, but the members of his own profession who, as he thinks, are themselves indifferent to the progress of science and to its utilization for the benefit of their country and profession. He criticises the methods usual in teaching mathematics, that ultimate basis of all engineering, and discusses in his characteristically original and forceful manner the defect of technical education in England and the defects of such as is attempted. Outside the work of the Science and Art Department at Kensington, he finds apparently little to approve. For that department he has cordial words of praise. His discussion may be taken as an important supplement to John Scott Russell's famous work.*

After reading these two little volumes one can hardly fail, however, to come to the conclusion that, while it is true that the American producer just now bursting into the field of

* 'American Engineering Competition,' being a series of articles resulting from the investigations made by the *Times*, London; N. Y. and Lond. Harper & Brothers, MDCCCCI. 8vo., p. 139. $1.00. 'England's Neglect of Science,' by Professor John Perry, M. E., etc., London. T. Fisher Unwin, 1900. 8vo., p. 113. $1.00.

* 'Systematic Technical Education,' London, 1869.

foreign consumption with his cheap but well-made 'interchangeable' wares, owes his seemingly meteoric success to applied science and in large part, in these later years, to the introduction into his manufacturing and transportation organizations of scientifically trained men, and while it is unquestionably the fact that Great Britain is suffering from neglect of science, and from the barbarous spirit and ignorance of her trades-unions, the real, the fundamental, element of difference probably lies behind all this. The ultimate cause of these developments of the United States which have so astonished the world is that perfect freedom, political and conventional, that freedom of the individual to mark out his own life and strive for his own highest goals, unhampered by governmental dictation or by bonds of caste, which has given the American citizen hope, ambition, purpose and effective energy. It is this which gave him invention, power of achievement, his patent laws, his legislation in behalf of essential industries, even his alert mind and his patriotism and love of country. It is this which has given us our common schools, which has promoted the organization of schools of the arts and trades and productive professions and the whole system of technical education and of industrially applied science. This has given our capitalist a new use for accumulated wealth in the endowment of schools of science and the promotion of education generally, has induced the adoption of organized industrial systems on such an enormous scale and has permitted the introduction of labor-assisting machinery without serious opposition on the part of those certain to be ultimately most benefited by the resultant increase of wages and decreased costs of product. Great Britain is still under the enslaving influences, in large degree, of convention and caste, and it is mainly this which lies at the bottom of her slow progress in the adoption of modern scientific methods, of improved systems and of extensive and intensive technical education.

Meantime, these two books will serve for the present as admirable summaries of progress to date and, later, will have great value historically.

R. H. Thurston.

*THE MALARIA EXPEDITION TO NIGERIA.**

The detailed report of the expedition sent out to West Africa last year by the committee of the Liverpool School of Tropical Medicine has not yet been completed, but its main conclusions can now be given. The expedition was under the direction of Dr. H. E. Annett, demonstrator at the Liverpool School of Medicine. Its main objects were: (1) the exploration and investigation of the conditions under which malarial fever occurs and is conveyed to Europeans, (2) the possibility of adopting any preventive measures against the disease, and (3) the corroboration and extension of recent discoveries and researches on the subject. In Nigeria there are no large communities of Europeans such as at Lagos, Accra, Cape Coast and Sierra Leone, but there were from three to ten white men at each of the stations, with the exception of Old Calabar and Lokoja, where they number a hundred or more. The observations of the members of the expedition confirm the recent discoveries regarding the cause of malarial fever and more especially the part played by mosquitoes of the genus *Anopheles* as the carrier of the disease from an infected to a non-infected person. The examination of the blood of the natives themselves corroborated the work of Professor Koch in the East Indies, and of the members of the Royal Society's Commission on Malaria in West Africa, that the blood parasite which gives rise to malarial fever in man is carried by the mosquito from the native to the European—and more especially from the native children. The examination of the blood of hundreds of native children revealed the interesting fact that between 50 and 80 per cent. of those under five years, between 20 and 30 per cent. of ages between five and ten years, and a small percentage over ten years contained malarial parasites, often in very large numbers. The breeding places of the *Anopheles* were found to be chiefly the dug-out native canoes in the regions of the mangrove swamps, claypits and puddles in the forested district, and at Lokoja puddles and ditches on and alongside the roads and footpaths. It was particularly noticed everywhere how carelessness in the construction of roads and footpaths, and more es-

* From the London *Times*.

pecially in the laying out of the areas surrounding the factories of the European traders was accountable for the production of a large number of breeding places for mosquitoes, which could easily have been avoided. In fact, it is certain that in West Africa such conditions are far more dangerous and more common than the proximity of a marsh or swamp, which is often noted as a cause of fever. Indeed, the mangrove swamp of West Africa has no direct relation to malarial fever, its presence only tending to predispose to a condition of general health rendering the subject more likely to the attack of disease in general. The observations of the members of the expedition lead them to very definite conclusions as to the methods to be adopted for the prevention of malarial fever among Europeans in West Africa. They consider that many of the methods which have been suggested are absolutely impracticable in West Africa—such as the universal dosing of infected persons with quinine for a period, the use of mosquito-proof houses, and of mosquito curtains, and the planting of trees of various kinds; although they are of opinion that such measures among an intelligent and obedient community may be of some efficiency. The two methods upon which alone any reliance can be placed as measures for prevention are (1) segregation of Europeans from natives of all sorts, at a distance of about half a mile; and (2) complete and efficient surface drainage of the whole district in the immediate neighborhood of European quarters. The adoption of these methods in many of the places visited by the expedition would be, even now, easy; in others, especially in the larger towns, it would involve considerable difficulty; but in the stations likely to be made in Nigeria in the near future their adoption would lead to the formation of malaria-free habitations.

---

*CONCILIUM BIBLIOGRAPHICUM.**

THE beginning of the twentieth century marks a new period in the history of the Concilium Bibliographicum. It is now just ten years since the origin of the movement which led in 1895 to the official foundation of the institution by the vote of the Third International Congress of Zoology.

Means were provided for carrying on the work for a preliminary period of five years, in order to determine whether the project could be made a success. The experimental stage is now passed and the verdict of all those who know the work well is that the high hopes entertained for the undertaking have been completely justified.

NUMBER OF CARDS PUBLISHED.

	1896	1897	1898	1899	1900	Total
Zoology, systematic	3345	2291	7539	7960	8452	29587
Zoology, topical			7583	8434	7877	23894
Zool., alphabet. (cross-references)				350	1256	1606
Anatomy		583	1857	936	1875	5251
Physiology		150	1230*	1270	433	3083
	3345	3024	18209	18950	19893	63421

A recent report of the Swiss Society of Naturalists endeavors to estimate in a specific case the saving of time afforded by the card catalogue in obtaining references to recent publications in regard to the trout. The saving is estimated at half a day. But in regard to other cases the saving is far greater. Let any zoologist familiar with past bibliographical resources consider how he would go to work to ascertain what has been published in the past five years in regard to some minute question, such as the fauna of Sumatra. A moment's reflection will suffice to show that it would be a task of many weeks to obtain an answer to such a question. Yet a subscriber to the faunistic part of the bibliography of the *Concilium* would only require a few seconds to find 62 publications dealing with the question. The titles of ten of these publications would, it is true, bear no mention of Sumatra; they are classed here because on perusing the text important references to Sumatra were found. Some, indeed, bear titles that would seem absolutely to preclude any notes on the fauna of Sumatra, as, for example, a work on 'The Insects of Germany.' Subscribers to any considerable portion of the bibliography would have received these references for 80 centimes (8d. or 16 cents), and any per-

* From the general statement for 1900.

* An error was made in this item in our last annual statement, which we now correct.

son, whether a subscriber or not, could receive the information for 3 fr. 10 (2s. 6d. or 62 cents). Surely no comment is necessary to prove the value of the work nor the extreme cheapness of the service.

The gradual success of the work from a scientific standpoint has led to a corresponding improvement of the financial status of the work. For the first three experimental years there was an average annual deficit uncovered by the subsidies of Frs. 5625, while for the last year this deficit had fallen to Frs. 224.

All this has now induced the Swiss Government to take a step which decided the entire future of the enterprise. By a recent vote of parliament its subsidy isi ncreased fivefold, and arrangements are being made to give the work permanence by making it independent of the person of the present director.

In the past year great progress has been made towards bringing the bibliography up to date. For certain departments it is already the most complete bibliography in existence. At present the malacological department, which had been far behind, is being brought up to the standard of excellence maintained by the whole. Later, attention will be given to protozoa and worms, especially as regards notes contained in medical journals, and finally crnithology will follow.

The anatomical bibliography has recently received renewed attention. Indeed the number of titles is more than double that issued in the previous year and yet they form but a small part of the extensive manuscript now ready for publication. The publication of the physiological bibliography, on the other hand, has been suspended and can not be resumed for two or three months, in consequence of technical difficulties which can only be overcome by the purchase of new machinery. This unfortunately can not yet be obtained from the factory. In the meantime a complete set of guide-cards has been published.

The Concilium owns a manuscript card catalogue of new genera and species (including new names) which are recorded as soon as published. From 1901 on, copies of any part of this catalogue may be obtained at the uniform charge of 10 centimes per entry (minimum 50 centimes). Since the cards are arranged faunistically as well as systematically, most diversified orders can now be received, *e. g.:* New genera and species of trichoptera, of bombycids, etc., new genera and species described from the Cape Colony, from the Philippines, from Texas, from Perthshire, etc., new reptiles from Japan, or simply new species of Carabus or any other genus.

The usefulness of a card catalogue depends largely on its being properly mounted and supplied with guide-cards. The sets of guide-cards issued in previous years are described in a special circular. A description of the new card cabinets of the Concilium is also the object of a special pamphlet. American subscribers would find it, however, more profitable to turn to the well-known Library Bureau.

The cards thus far published have been taken from no less than 1,576 periodicals. A list of journals showing precisely what volumes and numbers have been excerpted is in preparation and will, it is hoped, soon be issued. Experiments are being tried with a view to opening new facilities of subscription in regard to the great faunistic areas. But above all, our program for 1901 is to render the references more complete and to approach more nearly our final aim, which is to *remove the entire burden of bibliographical research from the shoulders of the working biologist.*

In closing, we wish to thank especially the Swiss Government and the Elizabeth Thompson Science Fund for their generous support in the past, without which none of this work could have been carried on.

SCIENTIFIC NOTES AND NEWS.

Dr. H. A. Rowland, professor of physics in the Johns Hopkins University, died suddenly on April 16th.

Professor J. Willard Gibbs, of Yale University, has been elected an honorary member of the London Physical Society.

The University of St. Andrews conferred its LL.D. on Mr. Alexander Agassiz, of Harvard University, in April. Mr. Agassiz returned from his visit abroad last week.

The Board of Visitors to the U. S. Naval Observatory held its first meeting at Washing-

ton last week, with all the members in attendance. Professor Young, of Princeton University, was elected Chairman and Professor Stone, of the University of Virginia, Secretary. The members of the Board were received by President McKinley. They visited the observatory, and held a number of sessions, but the proceedings have not been made public.

AT the last meeting of the Rumford Committee of the American Academy of Arts and Sciences a grant of $300 was awarded to Professor Arthur A. Noyes in aid of a research on the effect of high temperatures upon the relative conductivity of aqueous salt solutions.

DR. W. KARAWAIEW has been appointed director of the zoological station at Sebastapol.

THE Washington Academy of Sciences has announced for Wednesday, April 17th, at 8:15 P. M., a lecture in honor of the National Academy of Sciences by Professor Alpheus Hyatt on 'A New Law of Evolution.'

THE spring lectures before the Royal Institute, London, include: Dr. Allen Macfadyen, six lectures on 'Cellular Physiology,' with special reference to the enzymes and ferments; Professor Dewar, three lectures on the 'Chemistry of Carbon'; Professor J. B. Farmer, two lectures on the 'Biological Characters of Epiphytic Plants,' and Mr. J. Y. Buchanan, three lectures on 'Climate, its Causes and Effects.' The Friday evening meetings will be resumed on April 19th, when a discourse will be delivered by Professor J. J. Thomson, on the 'Existence of Bodies Smaller than Atoms.'

As we have already announced, Mr. J. H. H. Teall has succeeded Sir Archibald Geikie as director-general of the British Geological Survey. *Nature* now announces the following further changes in the staff: Mr. H. B. Woodward to be assistant director (for England and Wales), and Mr. John Horne to be assistant director (for Scotland); Mr. C. Fox Strangways, Mr. Clement Reid and Mr. Aubrey Strahan to be district geologists for England and Wales; Mr. B. N. Peach and Mr. W. Gunn to be district geologists for Scotland, and Mr. G. W. Lamplugh to be district geologist for Ireland.

PROFESSOR RUDOLPH VIRCHOW will be eighty years old on the 13th of October. When he celebrated his seventieth birthday, a fund was collected in his honor for the endowment of scientific research, and a committee has now been appointed to increase this fund as a further testimonial to Germany's greatest living man of science. It is intended that the testimonial shall be international, and a committee has been appointed in America consisting of Charles A. L. Reed, President of the American Medical Association; Henry P. Bowditch, President of the Congress of American Physicians and Surgeons; William H. Welch, Johns Hopkins University; Robert F. Weir, President of the New York Academy of Medicine; A. Jacobi, 110 West 34th Street. To Dr. Jacobi, who is secretary of the committee, subscriptions may be sent.

THE Geographical Society of Leipzig has made the first award of its Edward Vogel gold medal to Professor Schweinfurth, of Berlin. The Society has elected as honorary members: Professor Penck, of Vienna; Professor von den Steiner, of Berlin, and Dr. Alph-Stuebel, of Dresden.

KING EDWARD has consented to become patron of the Royal Institution, London.

PROFESSOR BRANNER, of the University of California, has sent us an extract from the *Southern Cross*, a newspaper published at Buenos Ayres, which gives a description of the unveiling of a monument in honor of the geologist, Burmeister, lately director of the National Museum in Calle, Peru. The monument is the work of the German sculptor, Aigner, and was erected by public subscription at a cost of $12,000. The statue, which is of marble on a large pedestal, represents Burmeister seated, holding a mineralogical specimen in his right hand. Commemorative addresses were made by the minister of public instruction and others.

WE record with much regret the death of Dr. William Jay Youmans, which occurred on April 10th, at Mt. Vernon, at the age of sixty-two years. Dr. Youmans, after a thorough education in science and medicine, joined his brother in the establishment of the *Popular Science Monthly* in 1872, and was editor-in-chief

of that journal after the death of his brother in 1887, until last year. In the editorship of the *Monthly* and in many other directions Dr. Youmans did much for the diffusion and advancement of science in America.

We also regret to record the death of Professor John Thomas Duffield, for more than forty years professor of mathematics in Princeton University. He was born in Pennsylvania in 1823, and graduated from Princeton College in 1841, where he was first appointed tutor in Greek and in 1847 adjunct professor of mathematics. Dr. Duffield was the author of various publications on religious and mathematical subjects.

Mr. Arthur Coppen Jones died, at Davos, on March 8th, at the age of thirty-five years. Mr. Jones studied under Huxley at the Royal School of Mines, but was compelled to go to the Engadine when only 20 years old, owing to an attack of tuberculosis. When his health improved, he studied bacteriology and was the author of a paper advocating the view that the tubercle bacillus is a fungus. He translated Fischer's 'Structure and Function of Bacteria,' recently issued from the Clarendon Press.

Dr. Franz Melde, professor of physics in the University at Marburg, died on March 16th at the age of sixty-eight years.

Mrs. Emma Flower Taylor, daughter of the late Roswell P. Flower, has given $60,000 to Watertown, N. Y., for a public library in memory of her father.

The committee, appointed by the International Congress of Geologists on the 25th, of August last, has announced as the subject proposed for the Spendiaroff prize for 1903 'A Critical Review of the Methods of Classification of Rocks' (Revue critique des mèthodes de classification des roches). The value of the prize is 456 roubles or about $240. Manuscripts should be addressed to M. Charles Barrois, secrétaire général du Congrés Gèologique International, 62, boulevard Saint Michel, Paris. At least two copies of papers submitted in competition are required, and they should be sent, at the latest, a year before the next session of the Congress in 1903.

Professor Todd writes from Port Said on March 25th, stating that the expedition sent from Amherst College under his direction to observe the eclipse of the sun in the Dutch East Indies, has reached that point two days ahead of his ephemeris and should be in Singapore on or before April 15th. The station for this observation of the eclipse is likely to be the little island of Sinkop, one of the lesser dependencies of the Sultan of Rhiow, about a day's journey southeast of Singapore. In addition to Professor Todd's apparatus for photographing the corona, which is partly automatic, Dr. Wright, of Yale, has provided an equipment of apparatus for determining the photographic polarization of the corona.

An expedition to Samoa and the Pacific Islands for the study of mosquitoes in relation to the diseases which they bear has been planned at the instance of Dr. Patrick Manson. The sum of $5,000 has been subscribed anonymously and it is hoped that the British Government will assist. The *Lancet* states that here the investigators would set themselves to study the local mosquito, and, having obtained full knowledge of its habits, they would proceed to investigate the mosquitoes of an island in which malaria is endemic. They are then to convey the *anopheles* from the malarial to the non-malarial island and to endeavor there to breed the *anopheles* under laboratory conditions. In the aquarium thus formed there would be introduced certain plants and animals which are apparently peculiar to Samoa with the view to discover, in one or another of these, something antagonistic to the *anopheles*. The experiment would then be repeated under conditions as nearly natural as might be possible. Dr. Manson hopes that by this means there may be discovered a something which is hostile to the *anopheles*, and which may be subsequently turned to good account by being introduced into islands and localities where malaria is epidemic. The Pacific islands are suggested by Dr. Manson from the fact that they also afford unique opportunities for the study of filariasis and elephantiasis. In many of the islands this latter disease attacks from 20 to 50 per cent. of the population, and in others filariasis attacks from 30 to 60 per cent. But there are also small islands with populations of

from 200 to 300 in which elephantiasis is alleged not to exist, while there are other islands, equally small in population, where almost every individual is affected.

THE *Princeton Alumni Weekly* states that another geological expedition to the far West is projected for next summer, for the purpose of adding to the very valuable collections already in the university museums, a large part of which have been gathered by this means during the last twenty-five years. Ten or a dozen upper classmen are expected to compose the party, besides Dr. M. S. Farr, '92, the new curator of vertebrate paleontology, who will be in command, since Professor W. B. Scott, '77, who has led so many of these expeditions, expects to be in South America next summer. Southern Montana will be the principal field of exploration, though, after two months of research, the party will have a pleasure trip of two or three weeks in the Yellowstone National Park. Dr. Farr expects to go out to Montana about the middle of May to make the arrangements, the other members of the party following after commencement.

THE American Physical Society will hold its next meeting in New York City, on April 27th. The program committee is Professors J. S. Ames, M. I. Pupin and Ernest Merritt.

THE Secretary of the National Educational Association, Mr. Erwin Shepard, has sent out a notice stating that the arrangements for the fortieth annual convention at Detroit next July are progressing satisfactorily. The hotels have agreed not to advance their rates and accommodations for ten thousand teachers are being secured in private houses. The official program will be issued on May 1st.

THE eighteenth annual meeting of the American Climatological Association will be held at Niagara Falls on May 30th and 31st and June 1st. The program includes a special discussion on the home treatment of tuberculosis.

THE Congrès des Sociétés Savantes held last week its annual conference at Nancy. Various geological and archeological explorations have been arranged to follow the Congress.

THE inaugural meeting of a society for the study of psychology by experimental methods was held in London on April 16th.

THE Anatomical Society of Great Britain and Ireland will hold its summer meeting at Leeds on July 5th and 6th.

THE spring meeting of the Iron and Steel Institute of Great Britain will be held on Wednesday and Thursday, May 8th and 9th, at the Institution of Civil Engineers, London. The retiring president, Sir William Roberts-Austen, will introduce the president-elect, Mr. William Whitwell, who will deliver an inaugural address. The Bessemer Gold Medal for 1901 will be presented to Mr. J. E. Stead. The autumn meeting of the Institute will be held in Glasgow on September 3d and following days.

THE U. S. Fish Commission will make an elaborate exhibit at the Buffalo Exposition, and this is now being arranged by Mr. W. de C. Ravenel, assistant in charge of the division of Fish Culture. There are to be fifty tanks containing fresh and salt water fishes shown as nearly as possible in their natural surroundings. Hatcheries will be in operation throughout the entire summer. There will also be a full exhibit of methods of fishing and of the products of fisheries, including the secondary products, such as oil, shells, skins, etc.

WE learn from the British *Medical Journal* that the Institute of Tropical Medicine established by the Senate of Hamburg, with the support of the German Empire, will shortly be in working order. It is housed in the Old Seamen's Hospital, Hamburg. The director of the Institute is Dr. Nocht, formerly port medical officer of Hamburg. He did admirable service to Hamburg in the cholera epidemic of 1892. He was formerly a surgeon in the German army, and afterwards worked under Professor Koch in the Institute of Hygiene at Berlin. Dr. Nocht has made original researches on the parasitology of malaria. He will have as his assistant in his new office Dr. Ollwig, who accompanied Professor Koch in his tropical expedition.

A MUSEUM of ethnology has been established at the University at Breslau, through the efforts of Dr. Thilénius, professor of anthropology and ethnolog .

In connection with the Munich veterinary school, a station has been established for the study of the diseases of fishes.

Plans for the lion house of the New York Zoological Park have been approved by the executive committee of the Zoological Society.

Sir John Murray, who has just returned from a six months' expedition to Christmas Island, during which he crossed the island from end to end—the first occasion on which it has been traversed—has made a statement with reference to his travels to a representative of Reuter's Agency. Christmas Island, which is situated in the Indian Ocean, is 220 miles from the nearest land, and is some 12 miles long by seven broad. It is covered with dense forest, having an area of nearly 50 miles, and the sea depth around its shores is between three and four miles. There is no good anchorage, but only an open roadstead. When Sir John Murray was on the island there were 13 whites, including a doctor, chemist and engineer, living there with their families, together with 720 Indian coolies engaged in working the rich phosphate deposits. The animals and plants on the island are of extreme interest. The whole place is overrun with curious red crabs as much as 18 inches across. They are excel lent tree climbers, and once a year there is a regular migration of these crustaceans, who travel in bodies like ants, taking 15 days on the journey, and returning inland after hatching their eggs. There are only five mammals on the island, including two species of rat not known elsewhere. They are of two colors, those on the plateau being brown, while those nearer the coast are black, and in order to keep them down a number of terriers have been imported. On the island are also to be found a toothless snake and a blind snake much like a worm. In exploring the island Sir John Murray had to cut a track through the dense forest until he reached the central plateau at an altitude of 1,000 feet, where traveling was not so difficult. One night he got lost in the forest, and had to subsist on the tops of sago palms, which he cut down. The island is under the Straits Settlements Government, and a resident magistrate has just been despatched thither from Singapore, together with an official of the Public Works Department, a scientific commission, and a force of police, 35 in all. They will select sites for the administrative buildings to be erected on the island. The climate is perfect, like a hot English summer, and prior to the British annexation no human being is supposed to have lived on the island.

The annual general meeting of the Chemical Society was held at Burlington House, London, on March 28th. Professor T. E. Thorpe, the president, made an address in the course of which he said according to the London *Times*, that they were proud to think that the Society, in so far as it had administered to the progress of chemistry, might have contributed in some measure to the luster of the reign which had been eminently associated with the spread of science. They had never been unmindful of what their science owed to the royal family, and in particular to the late Prince Consort. They entered on the 20th century mustering 2,368 members, including 33 foreign members. Since the last anniversary 182 communications had been made to the Society, a number greater than that of any preceding year. The volumes published in 1900 by the Society contained 3,758 abstracts of papers, which had appeared mainly in continental journals. For some time past their sister society in Berlin had had under consideration the desirability of establishing, with the cooperation of the various chemical societies in Europe and America, a uniform system of atomic weights. The committee appointed by the Society had decided to recommend that $O = 16$ be taken as the basis of calculation of atomic weights, and that in assigning a number as the atomic weight of any element only so many figures should be employed that the weight might be regarded as accurately known to one unit in that figure. Some discussion had taken place with regard to the time of the Society's meetings, and the council had decided provisionally to hold the meetings during the coming session at 5:30 P. M. on the first and third Wednesdays of the month. Professor Reynolds J. Emerson was elected president for the ensuing year.

A despatch from New Orleans to the daily papers states that the investigation made by Professor Beyer for the American Ornithologi-

cal Association of the Louisiana Gulf Coast for the purpose of stationing wardens to protect the sea birds shows that action was not taken a moment too soon. Professor Beyer found that nearly all the breeding places of the birds had been destroyed by killing the birds themselves and taking their eggs. Not a trace of birds was found on either Brush or Caillou islands, at one time the home of millions of seafowl. The same was true of Calumet and Castelle islands, on which every living thing had been killed. A few gulls and hens were found left on Timbalier Island, and there are said to be a few on Last Island which, however, could not be visited on account of the severe weather. Wardens were appointed wherever birds were found and the fishermen of the neighborhood promised to cooperate with the wardens in preventing the killing of the birds in the breeding season and the stealing of eggs.

THE report of the British Consul at Naples for the past year, as summarized in the London *Times*, describes the recent progress of the Marine Zoological Station in that city, 'the mother of all similar scientific establishments in the world.' Its progress has continued with undiminished activity, and the number of biologists of all nationalities who have carried out their investigations there has largely increased. During the past two years 63 and 71 scientists respectively have availed themselves of the opportunities of research afforded by it. Among other students at the station there has been a regular succession of naval officers sent by the Italian, Russian, German and Spanish governments for the purpose of undergoing a course of training in the commoner methods employed in capturing, investigating and preserving marine organisms. The work done at the station is for the most part of purely scientific interest, but a great many of the contributions to science are of great and immediate practical value. A report of great scientific and economic value has been prepared by the Cavaliere Lo Bianco, the permanent naturalist attached to the station. It contains the results of many years' assiduous study of the seasons of the year at which the animals, as distinguished from the plants, which inhabit the Bay of Naples, breed.

THE Royal Irish Academy has this year taken a step, says *Nature*, which will, it is hoped, still further establish its position in Ireland, and in the world of sciences and letters in general. It has adopted the principle of the bye-laws of the Royal Society of London, respecting the mode of election of members; the council is now empowered to select a number of persons, not exceeding twelve, in each year, from the list of candidates for membership proposed, and to recommend these to the body of members for election. The members may, at the single annual meeting at which elections now take place, substitute the name of any candidate already proposed for that of any candidate selected by the council; but the number of candidates elected must not be greater than that fixed by the council for that particular year. Changes have been also made in the bye-laws so as to provide for the more frequent introduction of new blood into the council. The position of the Royal Irish Academy becomes at the same time defined in relation to the other great medium of scientific publication and intercourse in Dublin, the Royal Dublin Society. While the latter, by its objects and foundation, must be to a large extent a popular institution, performing its important public functions and scientific work by the support of an extensive body of members, the Royal Irish Academy is able, on the other hand, to maintain its membership as a distinction, and to attract to itself, by this circumstance, those who are mainly concerned with the furtherance of research.

PARTICULARS in regard to the research scholarship founded by Mr. Andrew Carnegie in connection with the Iron and steel Institute of Great Britain, of which association Mr. Carnegie is a vice-president are given in the London *Times*. For this scholarship Mr. Carnegie presented to the institute twenty two $1,000 Pittsburg, Bessemer and Lake Erie Railroad Company 5-per-cent. debenture bonds, the income derived from which will be applied to awarding annually one or more scholarships of such value as may appear expedient to the council of the institute. The awards will be made on the recommendation of the council irrespectively of sex or nationality. Candidates, however, must be under 35 years

of age, and application must be made on a special form to the secretary of the institute before the end of April in every year. The scholarships will be tenable for one year, but the council will be at liberty to renew them for a further period if thought desirable instead of proceeding to new elections. The object of this scheme of scholarships is not to facilitate ordinary collegiate studies, but to enable students who have passed through a college curriculum, or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. It is suggested that the National Physical Laboratory—on the governing body of which the Iron and Steel Institute is represented—would for many reasons be a very suitable establishment in which such a research could be carried out. There is, however, no restriction as to the place of research that may be selected, whether university, technical school, or works, the only absolute condition being that it shall be properly equipped for the prosecution of metallurgical investigations. The results of the researchs are to be communicated to the Iron and Steel Institute in the form of a paper to be submitted to the annual general meeting of members. If the paper appears to the council to be sufficiently meritorious the author will be awarded the Andrew Carnegie gold medal. The awarding of the medal in any year, however, will not be obligatory, but will depend upon a paper of sufficient merit being communicated.

In reply to those who have signed a petition objecting to the opening of the Edinburgh Museum of Science and Art on Sunday afternoons, Lord Balfour has written: "In point of principle I am unable to agree that a visit to a museum is a contravention of any divine law. If a citizen of Edinburgh may not go to a museum, by what right does any one of us enjoy a walk in our own or somebody else's garden? In deciding the practical question, I think we must keep in view the extent of the innocent gratification as well as improvement offered to those whose opportunities for both are otherwise limited. I believe that in these respects the advantages will be very great as compared with the amount of labor involved. Having regard to this, and bearing in mind the resolution of the House of Commons, I had but little difficulty in coming to the conclusion that it was my duty to decide the question of Sunday opening in the case of the Edinburgh Museum in the way I have done. I did not arrive at that conclusion without careful and anxious consideration, and I cannot hold out any hope that it will be reconsidered unless and until experience of its working in Edinburgh supplies proof that slight use is made of the opportunity offered or that its consequences are in some way detrimental to the public interests."

UNIVERSITY AND EDUCATIONAL NEWS.

By the will of the late Mrs. Josephine L. Newcomb, Tulane University will receive a large sum, said to be $2,000,000, for the Sophie Newcomb College for Women.

Mrs. P. D. Armour and her son Mr. J. Ogden Armour have given $1,000,000 to the Armour Institute, Chicago. This endowment will be used, it is said, to extend the work of the Institute in the direction of electrical engineering and chemistry.

The daily papers report that the endowment fund of $1,000,000 for the Johns Hopkins University has been practically collected and that the donors will be announced on May 1st. It is also said that President Gilman's successor will be announced at that time.

Mr. John B. Gilfellan, of Minneapolis, has given the University $50,000 for the assistance of poor students.

Creighton University at Omaha, Nebr., has received $75,000 from Mr. John A. Creighton for a new building.

The Board of Regents of the University of Minnesota has approved the recommendation of the faculties abolishing the degrees of bachelor of philosophy and bachelor of science, the degree of bachelor of arts being hereafter given for all liberal studies.

Miss Laura D. Gill will be installed as Dean of Barnard College on May 1st. A gift of $5,000 to the College from Mr. Jefferson Seligman has been announced.